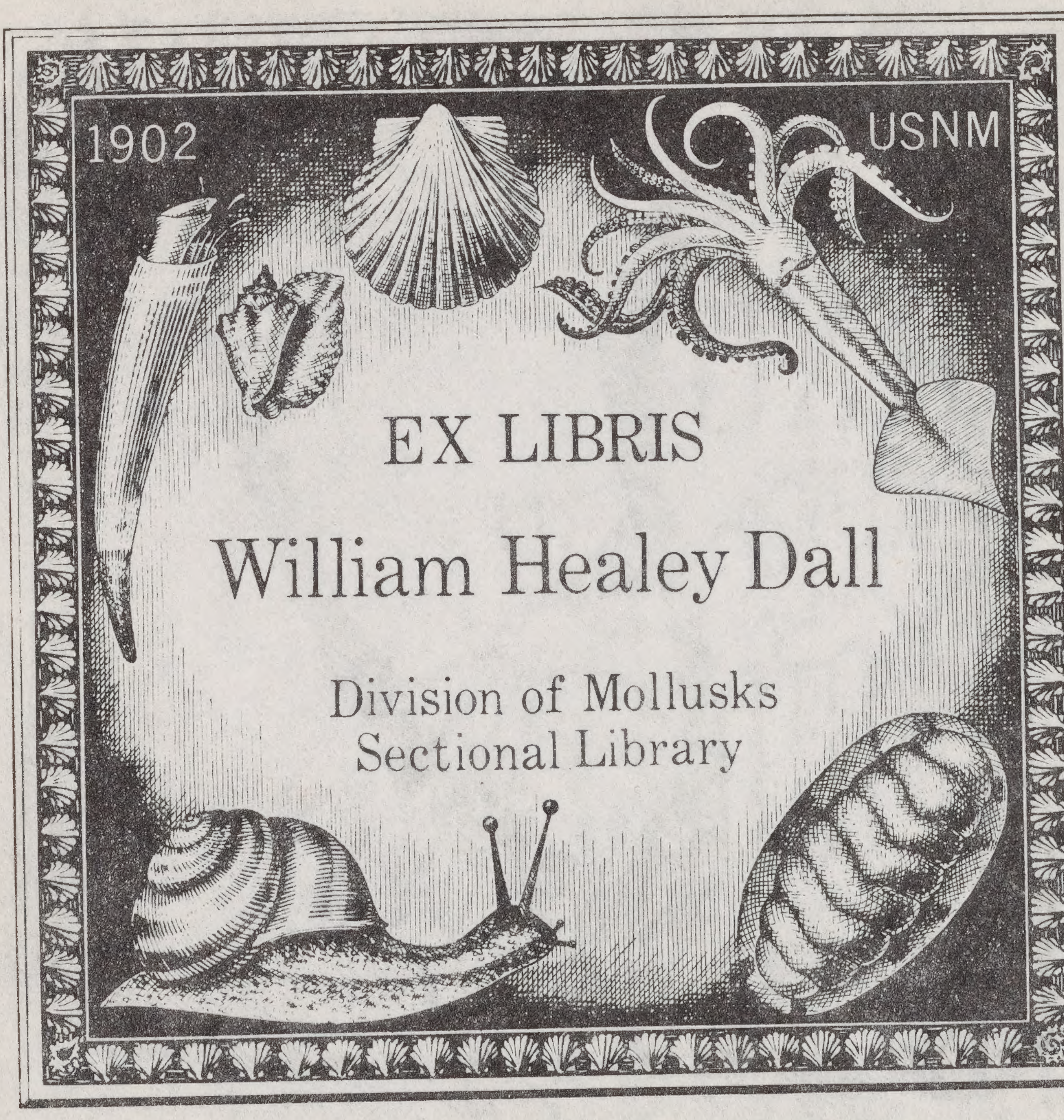

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(*Founded* 1874)

BEING THE ORGAN OF THE

CONCHOLOGICAL SOCIETY
OF GREAT BRITAIN AND IRELAND.

EDITED, UNDER THE DIRECTION OF THE COUNCIL,

BY

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VOL. 23. NOVEMBER, 1948 NO. 1

THE EDITOR.

THE readers of this *Journal* will have regretfully noted that Mr. J. R. le B. Tomlin is no longer Editor. He retires after forty years devoted to the service of the Society. At least two generations of conchologists have appreciated his continual help and his wide knowledge of shells, literature and all that relates to conchology, while authors have been grateful for advice and criticism, and his skill in detecting errors whether of author or printer. He retires with the gratitude and good wishes of us all.

The *Journal of Conchology* was established in February 1874 by J. W. Taylor, assisted by W. Nelson, as the *Quarterly Journal of Conchology*. They, with H. Crowther and W. D. Roebuck, founded the Conchological Club in 1876, to become in November 1877 the Conchological Society. The *Journal* and the Society were independent for some years, though the *Journal* recorded the proceedings of the Society, and in 1887 (*5*, 145–150) published the Constitution and a List of Members. With the beginning of the seventh volume in 1892 the *Journal* became the official organ of the Society, with W. E. Hoyle as Editor. He was succeeded in October 1907 by J. R. le B. Tomlin, whose first number, volume *12*, part 5, appeared in January 1908.

Marine Mollusca at Ainsdale, Lancashire.—Mr. W. Ramsden has sent me the following interesting account. On 2 March 1947 he noticed that along the upper part of the beach between Freshfield and Ainsdale there was a broad band of freshly fallen snow and also a line of frozen surf from 10 to 15 yards in depth and in places a foot or more in height. During the afternoon the snow thawed quickly in the warm sunshine. Due, no doubt, to the recent intense cold, hundreds of thousands of the small bivalve *Donax vittatus* (da Costa) had succumbed and been thrown up on the beach. A few were sufficiently alive to extrude the foot and make feeble but unsuccessful efforts to burrow. The sea-gulls and waders were eagerly feeding upon the masses of dead and dying molluscs. In all, eight species had been cast up on the sands either dead or only just alive, viz. *Natica poliana alderi* Forbes (fairly frequent), *Acteon tornatilis tornatilis* (L.) (frequent), *Tellina tenuis* da C. (occasional), *Tellina fabula* Gm. (frequent), *Donax vittatus* (da C.) (in hundreds of thousands), *Pharus legumen major* B., D. and D. (frequent), *Ensis ensis* (L.) (frequent) and *Mactra corallina cinerea* Mont.

Another observation of interest is that on one of the concrete anti-invasion posts *Mytilus edulis* L. and *Littorina littorea* (L.) were living amongst a mass of Balanus. The shore hereabouts is bare sand with no rocks, no stones and no algæ whatsoever, so how the winkles—three or more specimens ranging up to about ¾ inch in length—had managed to establish themselves is a bit of a mystery.

J. WILFRID JACKSON.

DEC 1 4 1948

A NEW SPECIES OF *PLEUROTOMARIA.*

By J. R. LE B. TOMLIN.

[PLATE 1.]

THE exploration of deeper and deeper areas off the South African coast has brought many new species to light and not a few new genera, while a new family, Abyssochrysidæ, was obtained from a thousand fathoms.

Recent species of *Pleurotomaria* have been known for nearly a century, but occur so rarely that the occurrence even of individuals is notable. The South African species, which is very distinct from those known so far, I am calling **Pleurotomaria africana**.

The type was trawled in 1933 in the crawfish grounds off Durban in 200 fathoms (station 237A), and is now in the South African Museum. Only one other example is so far known, taken on the same ground and now in the Durban Museum.[1]

The type is yellowish red, with whitish blotches placed quite irregularly ; the slot is 5 mm. wide and about 2 inches in length, bordered on either side with a raised red line : sculpture consisting of fine, close, regular, papillate spirals and close, regular, retractive, arcuate axials : the cicatrix which fills the upper part of the slot is marked by three or four spirals, and between the lower margin of the slot and the suture seven spirals run. The shell is markedly depressed, especially the body whorl, and the sutures are rather deep.

The upper margin of the slot forms a fairly acute keel ; the lower margin is very slightly raised.

The centre of the basal disc has a funnel-shaped hollow produced by a nacreous prolongation of the upper part of the lips, which descends to surround the lower margin of the nacre with a red edging.

Interior pearly. Number of whorls, ten, two of which are unsculptured and form the protoconch.

Diam. max. 100 mm. : alt. 83 mm.

The shell was recorded in *Fisheries and Marine Biol. Survey Report*, no. 10, pp. 20, 21, 1933 (for the year 1932).

In this Report it was provisionally identified as *P. quoyana* Fischer and Bernardi, but it is not at all like the figures and description given in *J. Conchyl.*, 5, 165, 166, pl. v.

It is more like the Japanese *P. hirasei* Pilsbry, but that is a stouter shell, much more elevated and with coarser sculpture.

A South African newspaper gave an extraordinarily fanciful notice of this discovery and stated that " it has a simple little name, Pleurotomariidæ Trochoidal ".

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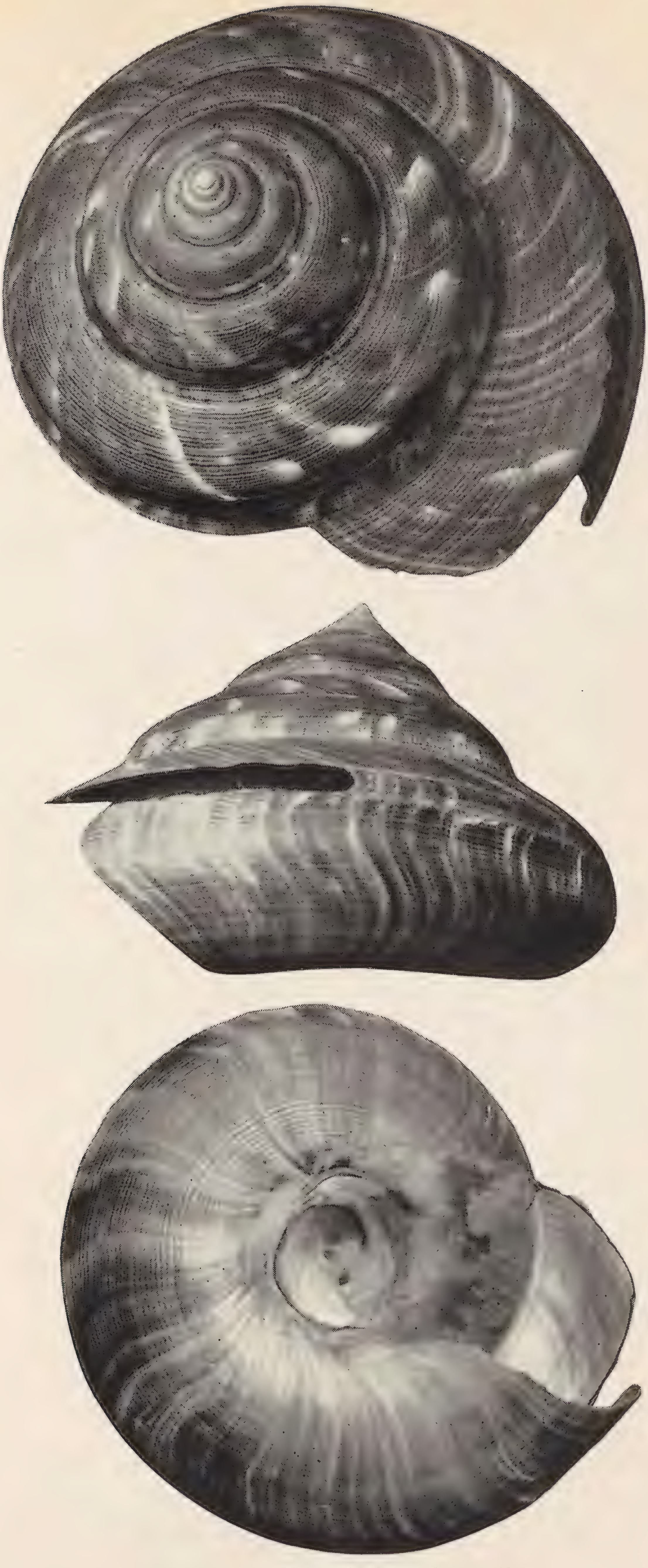
[1] Further specimens have since been obtained.



Pleurotomaria africana Tomlin.

THE ANATOMY OF *FUSITRITON ALGOENSIS* TOMLIN.

By KATHLEEN M. WHITE, M.SC., PH.D.
Honorary Research Fellow, Department of Zoology, University of Reading.

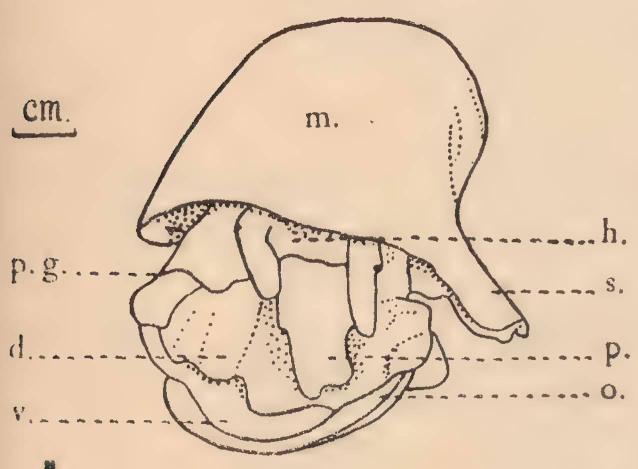
[5 TEXT-FIGURES.]

THE material was collected at Algoa Bay in 140 fathoms by Mr. Pringle of Port Elizabeth, and sent to me by Mr. J. R. le B. Tomlin, to whom I wish to acknowledge my debt. There are two specimens, both female, in a fair state of preservation and light brown in colour. Some idea of their dimensions can be obtained from the fact that the shell is 12 × 5·7 cm. The general appearance and anatomy is very like that of *Buccinum.* The siphon is 3·5 cm. long, consisting of a much thickened extension of the left side of the mantle simply folded upon itself, and on its upper side at the proximal end there is a rounded flap which slips into the cavity between the siphon and the body wall. The gill, which is about 6 cm. long, commences just behind this flap. Between the gill and the body, behind the origin of the former, is the osphradium. This is an organ 1·5 cm. long, consisting of greenish lamellæ attached to a central light brown axis. The osphradium is flat and attached to the mantle along the whole of its upper surface.

The head is 2 cm. across, with a median lobe and paired tentacles. The latter are 11–12 mm. long and have small black eyes on very slight swellings on the outer side of the base. The total length of the proboscis is 4·3 cm.; in one specimen it was completely retracted, in the other it was extended for 2 cm.; it varies in width from 7 mm. to 1 cm.

The external apertures are similar in position to those of *Buccinum.* The anus is situated on a papilla 2 cm. from the mantle edge on the right side of the animal, the oviducal aperture is a slit close to the body on the same side, and the renal aperture lies further back on the left of the rectum.

The radula is 2·6 cm. long and consists of about 125 rows with formula



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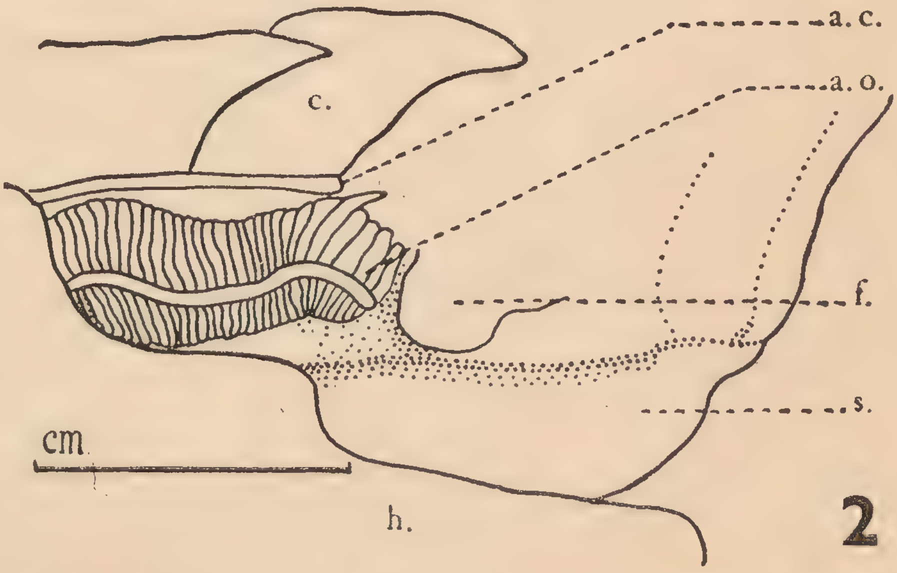

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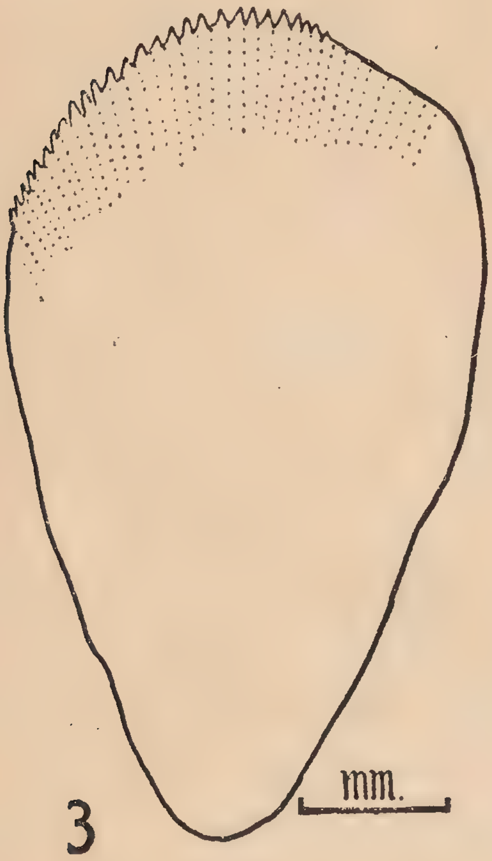
FIG. 1.—Animal. d, dorsal part of foot; h, head; o, operculum; p, proboscis; p.g, pedal groove; s, siphon; v, ventral part of foot.

FIG. 2.—a.c, ctenidial axis; a.o, osphradial axis; c, ctenidium or gill; f, flap on siphon; h, head; s, siphon.

1.1.1. The central is broad and somewhat shallow, with a median cusp bearing five rounded denticles. The lateral teeth are three pronged, the uppermost of which is the shortest and bears a varying number, about six, rounded denticles. The lowest prong is the longest and nearly meets its fellow in the middle line below the apex of the central tooth, not of its own row but of the row in front.

The jaw is bright brownish orange in colour and consists of rows of rectangular plates which meet the margin of the jaw at an angle, resulting in a serrated edge to the latter.



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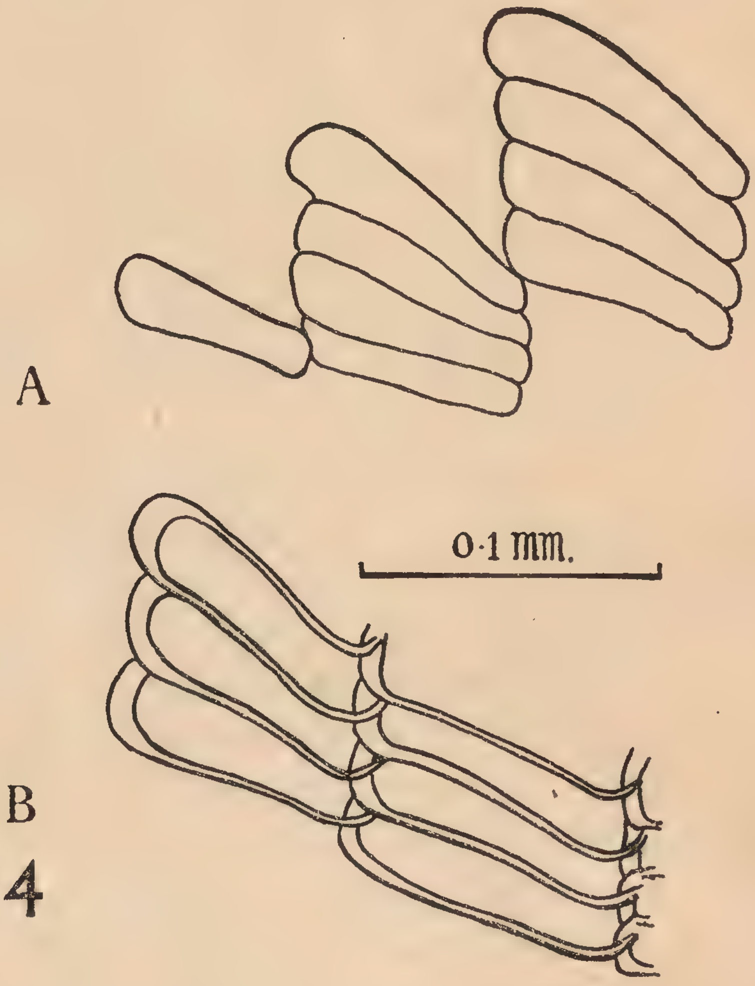

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FIG. 3.—Jaw.
FIG. 4.—Jaw plates. A, from edge; B, from centre.

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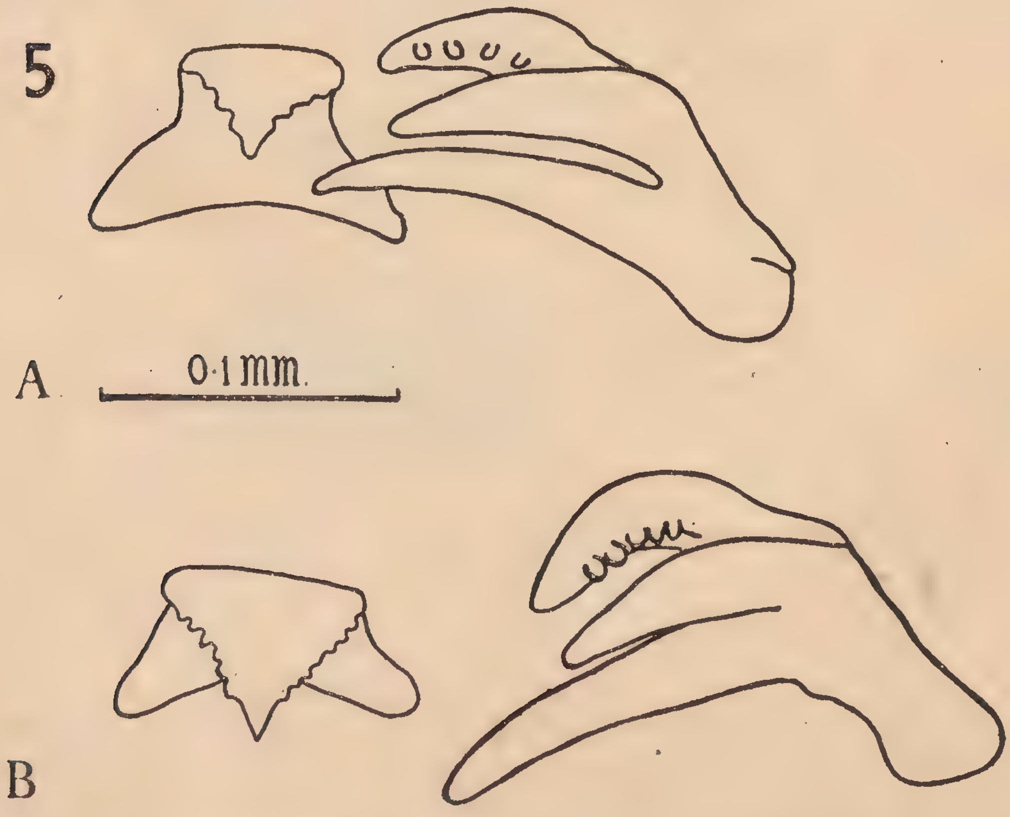
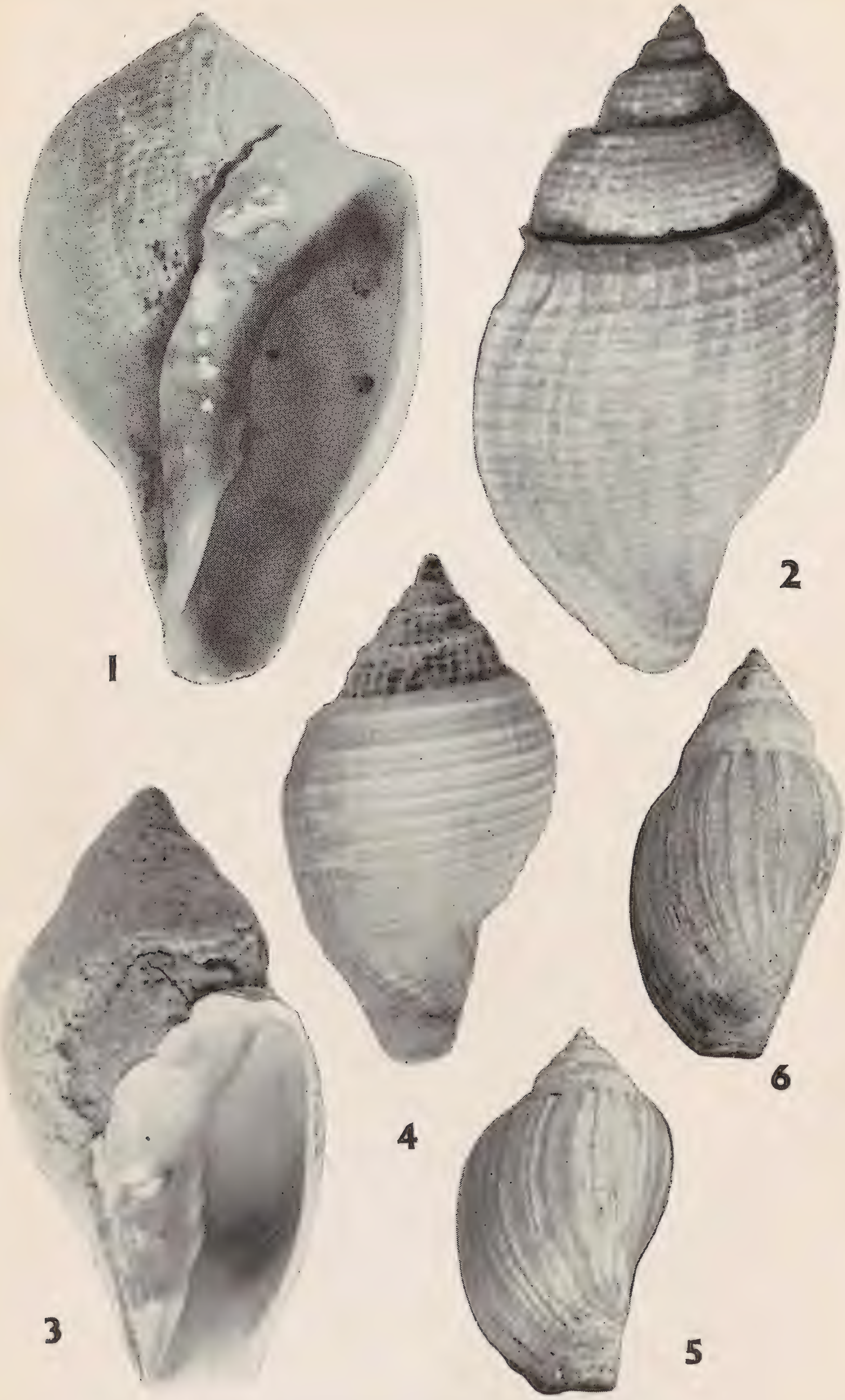


FIG. 5.—Radular teeth. A, from older part; B, from younger part.



Volutocorbis lutosa Koch.

A NEW SOUTH AFRICAN VOLUTE.

By H. J. Koch.

[Plate II.]

To add to the list of Volutidæ from South Africa comes this new species of *Volutocorbis* Dall. Specimens are taken in fair numbers in the trawl off Port Nolloth and the mouth of the Orange River. A striking characteristic of most of the specimens is that they are completely encased in a hard skin of clay about 0·2 cm. thick. This layer can be flaked off with the aid of a tool. In the area of the apex the clay cap can be removed intact, the inner side being a perfect mould of the protoconch and apex. The shell surface below the clay is chalky in many cases, showing signs of corrosion. Where the clay is thin, as is the case in some specimens, the surface of the shell is glossy and perfectly preserved. In some cases the animal has deposited nacreous material on a clay layer and so enclosed this between the body whorl and the rest of the shell.

This shell bears some resemblance to *Volutocorbis abyssicola* (Adams and Reeve) but is more squat, has fewer folds on the columella, and the sculpturing is never so sharp. Like *V. abyssicola*, the first spiral rib on the upper side of the body whorl is the strongest and the portion between this and the suture is at right angles to the vertical axis of the shell. In old specimens the spiral ribs are often hardly visible and the radial lines are very pronounced. See Plate II, figs. 5, 6.

Volutocorbis lutosa *spec. nov.*

Shell medium sized with acute apex, whorls five. Nucleus bulbous. There are numerous fine radial lines about 0·2 cm. apart, and these, with the spiral ridges about 0·15 cm. apart, give the shell a cancellated appearance. The surface of the shell in some cases has a chalky appearance due to corrosion. In uncorroded specimens the colour is cream. The inner side of the shell is of a pale orange-brown colour. The inner lip of the aperture is mildly ridged internally near the edge. The columella plaits are a nacreous white and number from three to five. The three plaits nearest the anterior end are the largest, the one nearest the anterior end being larger than any other. In the one young specimen examined the third fold was hardly noticeable. The whorls meet at the suture at right angles to the vertical axis of the shell. The height of the shell is approximately twice the width, some specimens being distinctly stouter than others. The aperture is two-thirds the length of the shell. The aperture is elegantly formed and is 1·5 cm. wide and 5 cm. long in a mature specimen. The middle edge of the lip is 0·5 cm. in advance of the anterior or posterior ends. The animal has a mauve body colour and is without operculum.

	Largest Specimens.		*Smallest Specimen.*
Height	8·0 cm.	7·0 cm.	4·5 cm.
Width	3·5 ,,	4·0 ,,	2·8 ,,
Length of aperture	5·0 ,,	4·8 ,,	3·4 ,,
Breadth of aperture	1·5 ,,	1·5 ,,	1·0 ,,

Habitat: Trawled off Port Nolloth between 40 and 60 fathoms.

I wish to express to the South African Council for Scientific and Industrial Research my gratitude for financial assistance.

EXPLANATION OF PLATE II.

Figs. 1, 2.—Type specimen (6 cm.).
Fig. 3.—Shell with clay encasement (5·5 cm.).
Fig. 4.—Juvenile (4·5 cm.).
Fig. 5.—Squat form (7 cm.).
Fig. 6.—Tall form (8 cm.).
Total height given in each case.

ON *MARGARITIFERA DURROVENSIS* PHILLIPS AND ITS AFFINITIES.

By Dr. Fritz Haas, Chicago Natural History Museum.

The Chicago Natural History Museum recently received a valuable addition to its collection of pearly freshwater clams, namely a specimen of *Margaritifera durrovensis* Phillips (No. 29111). For it we are under obligation to Mr. A. E. Ellis and to Mr. A. W. Stelfox. The specimen mentioned was collected by Mr. Stelfox in October 1936 in the River Nore, Queen's County, Ireland, the type locality for the species.

Margaritifera durrovensis puzzled me for a long time and I had tried in vain to procure a specimen of it. From the original description of its shell (Phillips, 1928) and its anatomy (Bloomer, 1928) it seemed very unlikely that *durrovensis* was really a distinct species. I had collected so many hundreds of *Margaritifera margaritifera* (Linnaeus) in many parts of Europe and had studied shells of this species in such vast quantities, both in the collection of Senckenberg Museum, to which I was attached until 1936, and in many other private collections and museums, that I was aware of the wide range of individual and local variation of the common European freshwater pearl mussel. All the distinctive features of the shell of *durrovensis* seemed to fall within this range of variation of *margaritifera*. Nor do the anatomical features of *durrovensis*, pointed out by Bloomer, show any qualitative differences from those of *margaritifera*, the quantitative ones being negligible. I therefore resolved to consider *M. durrovensis* a synonym of *M. margaritifera*, and treated it as such in my tentative list of the palearctic Unionidæ (Haas, 1940). I feel happy now to know that, as early as 1929, Stelfox had come to the identical conclusion.

There is no denying that *M. durrovensis* exhibits some strange features uncommon in typical *M. margaritifera*. This became even more evident to me when the first specimen of *durrovensis* came into my hands. I remembered immediately that I had seen similar specimens before. In fact, the form of *M. margaritifera* which was originally described as *Unio brunneus* Bonhomme, 1840, from the River Viaur, Aveyron, France (of which I had seen an authentic specimen in the Rossmaessler collection now in Senckenberg Museum), shares the general features with *durro-*

vensis, especially the brown colour of the conchine layer. Thus, the *durrovensis*-phase may appear in various widely separated localities, and this fact strengthens my belief that this phase is an environmental one, a phase caused by the special life conditions of its habitat, namely water rich in calcium carbonate.

It is well known that *M. margaritifera* appears in two environmental phases, according to the nature of the respective localities. Associated with and almost restricted to water destitute of lime, the freshwater pearl mussel occurs only in waters originating in granitic or gneissic rocks, or in the Triassic Bunter Sandstone; all other waters contain at least a certain amount of lime. Now individuals of *M. margaritifera* living in waters from archaic mountains are generally larger, longer, wider and somewhat thicker and more kidney-shaped than those from Triassic waters, which are mostly shorter, narrower and thinner. Under these circumstances individual names were certain to be given to these two phases of *M. margaritifera.* The name just mentioned and given by Linnaeus must be applied to the phase of archaic water, while Lamarck bestowed the name *elongata* on the phase living in the Triassic waters of the Western Vosges Mountains. Subsequent authors have added new names to this same phase, which can be found listed in Haas, 1940. In recent years, however, everyone seems to agree that the two phases of *M. margaritifera* cannot be separated as species.

To the best of my knowledge, almost nowhere has *M. margaritifera* ever been found in company with other unionids, and I think that only Clessin once mentioned having collected freshwater pearl mussels in a locality where they were associated with *Anodonta anatina.* I myself, in my many collecting trips, have met with only two cases in which *M. margaritifera* was not the only representative of the unionids. In both cases, specimens of the *Unio crassus*-group were the associates, namely members of a genus that never occurs in water destitute of lime. The two localities, the first of which is not yet mentioned in the literature, are the mountain creek Altfell, a tributary of the Weser, near Ilbeshausen, in the Vogelsberg Mountains, central Germany, and the little River Mudau, an affluent of the Main, near Miltenberg-on-Main, central Germany (Haas and Schwarz, 1913, 7). These few findings are important inasmuch as they prove that *M. margaritifera*, under conditions not yet known, is able to live in water in which lime is present. This fact once established, it becomes rather probable that the *Margaritifera* of the River Nore, in Ireland, also belongs to the species *margaritifera*, but has become established in water rich in lime and changed by this environmental factor into a distinguishable phase, to which the specific name *durrovensis* has been given. On the other hand, the distinctive characters of this *durrovensis*-phase seem insufficient to justify a specific or even a subspecific separation from *margaritifera.* I thus come to the conclusion that *durrovensis* is to be considered as representing the lime-phase of *margaritifera*, exactly as *elongata* represents the Bunter Sandstone phase and typical *margaritifera* the Archaic Rock phase. The name *durrovensis* Phillips thus becomes a synonym of *Margaritifera margaritifera* (Linnaeus).

The disappearance of the name *durrovensis* into the synonymy of *M. margaritifera* does not diminish the theoretical interest in this lime phase of a species that generally avoids calcium. The physiological problems involved in this passage into a bivalve dependent upon calcium are worthy of closer study, as I have pointed out in the section on lime-metabolism in my monograph of the bivalves (Haas, 1941, 568) in which I used *M. durrovensis* as an example.

So far as I am able to find, the name *durrovensis* has appeared in scientific literature only in the following cases :—

Margaritifera durrovensis Phillips, 1928, 69–74, pl. 3–5 ; Bloomer, 1928, 74–76, 1 fig. ; Haas, 1941, 568 ; Ellis, 1947, 10, figs. 3–5, pl. 4, fig. 22, pl. 5, fig. 25.

Margaritana durrovensis Stelfox, 1929, 7.

Unio durrovensis Kennard, 1941, 273.

Margaritifera margaritifera margaritifera Haas, 1940, 120 (*durrovensis* cited in synonymy).

REFERENCES.

BLOOMER, H. H., 1928. On *Margaritifera durrovensis*. Anatomical Notes. *Proc. Malac. Soc. London*, **18**, 74–6, 1 fig.

BONHOMME, J., 1840. Notice sur les Mollusques bivalves fluviatiles observés jusqu'à ce jour aux environs de Rodez. *Mém. Soc. Aveyron*, **2**, 429 *et seq.*

ELLIS, A. E., 1947. Freshwater Bivalves (Mollusca) : Unionacea. *Linn. Soc. London*, Synopses Brit. Fauna, No. 5, 39 pp., 12 pls.

HAAS, F., 1940. A Tentative Classification of the Palearctic Unionids. *Zool. Ser. Field Mus. Nat. Hist.*, **24**, 115–141.

—— 1941. Bivalvia, Teil II, Lief. 3. Bronn's *Klass. Ordn. Tierreichs*, **3**, 467–678, figs. 166–207.

—— and SCHWARZ, E., 1913. Die Unioniden des Gebietes zwischen Main und deutscher Donau in tiergeographischer und biologischer Hinsicht. *Abh. Kgl. Bayr. Ak. Wiss., Math.-phys. Kl.*, **26**, No. 7, 32 pp., 4 pls., 1 map.

KENNARD, A. S., 1941. List of the British non-marine Mollusca. *J. Conchol.*, **21**, 260–274.

PHILLIPS, R. A., 1928. On *Margaritifera durrovensis*, a new species of pearl mussel from Ireland. *Proc. Malac. Soc. London*, **18**, 69–74, pls. 3–5.

STELFOX, A. W., 1929. Land and Freshwater Mollusca. *Proc. Roy. Irish Acad.*, **39**, Sect. B, 5–10.

Mya arenaria L. in Orkney.—*M. arenaria* still flourishes in considerable numbers in the loch of Stenness and, as remarked in Forbes and Hanley (*1*, 172), is much diminished in size and thickness. Indeed, it is quite fragile and unlike the more solid specimens we are accustomed to from the shore. There is no sign of its dying out ; it seems to have adapted itself permanently to the brackish conditions of the loch and is found even near Brodgar, quite a distance from the sea inlet of the loch.

ROBERT RENDALL.

OBSERVATIONS ON THE DISTRIBUTION OF *HELICELLA CAPERATA* AND *TRICHIA STRIOLATA.*

By D. S. Johnson, B.A., and J. Lowy, B.A. (from the Zoological Laboratory, Cambridge).

[2 Text-figures.]

Helicella caperata (Montagu) and *Trichia striolata* (Pfeiffer) are among the commonest snails occurring around Cambridge, and they are present in large numbers on the verges of grass and coarse herbage along many roads in the area. Observation of several colonies indicated that in such circumstances *H. caperata* was usually to be found on narrow-leaved plants and grasses, while *T. striolata* occurred principally on broad-leaved plants.

In order to obtain quantitative data two colonies, separated by a difference of several miles, were chosen as test colonies and the distribution of the two species within each colony was determined. Colony A was situated on the Girton side of Huntingdon Road about 100 yards beyond

Table I.

Distribution in the Field of Two Colonies of *H. caperata* and *T. striolata*.

Plants	Number of Snails			
	Colony A		Colony B	
	H. caperata	*T. striolata*	*H. caperata*	*T. striolata*
Gramineæ	52	6	18	5
Straw	18	3	—	—
Senecio jacobæa L. . .	—	—	2	—
Cirsium sp. " A " . .	—	—	1	—
Æthusa cynapium L. . .	—	—	1	—
Plantago lanceolata L. .	—	—	2	—
Total, Narrow-leaved .	70	9	24	5
Trifolium pratense L. .	—	1	—	3
Rubus fruticosus L. . .	1	10	—	—
Hieracium sp.	—	2	—	—
Convolvulus arvensis L. .	3	6	—	—
Artemisia absinthium L. .	1	—	—	—
Potentilla reptans L. . .	1	—	—	—
Arctium lappa L. . .	—	—	6	11
Ranunculus repens L. .	—	—	—	1
Bryonia dioica Jacq. . .	—	—	—	3
Cirsium sp. " B " . .	—	—	—	1
Nepeta hederacea L. . .	—	—	—	1
Unidentified Broad-leaved.	1	3	2	1
Total, Broad-leaved . .	14	65	8	21
Ground	—	10	—	2

Girton College, and Colony B near the Fen Bridge on the road from Milton to the Halingway. In each of the colonies the habitat consisted of rough herbage bordering a roadside.

The distribution of the snails was determined by taking quadrats of 1 square foot at random over the area of a colony and recording the number of each species occurring on the various plant types within the quadrats. As the study was primarily a comparison between the distribution of the two species, no attempt was made to estimate relative areas covered by the different plant species. The results for the two colonies are recorded in Table I.

The figures show no marked association of either form with any particular plant species, but demonstrate that *H. caperata* occurs mainly on narrow-leaved plants and *T. striolata* on broad-leaved plants.

Two theories were considered as possible explanations of the facts and tested experimentally. It was thought that there might be different humidity conditions around broad-leaved and narrow-leaved plants, and that such differences might be appreciated by the snails; particularly since Ellis (1) states that *H. caperata* prefers arid and *T. striolata* humid situations.

A simple preference test was conducted on the lines of that devised by Gunn (2) working with Isopods. In order to show up any behavioural differences the apparatus used was in the form of a long glass tube (length 45 cm., diameter 12 cm.) closed at the end. A perforated zinc sheet covered with cellophane divided the tube longitudinally into an upper and lower chamber, and a semi-circular piece of bakelite partitioned the lower chamber. The latter contained calcium chloride on one side and dishes of water on the other. Paper hygrometers were inserted at both ends of the tube. After two or more hours' equilibration the positions taken up by the snails were noted. The results are recorded in Table II.

TABLE II.

DISTRIBUTION OF *H. caperata* AND *T. striolata* IN A HUMIDITY CHAMBER.

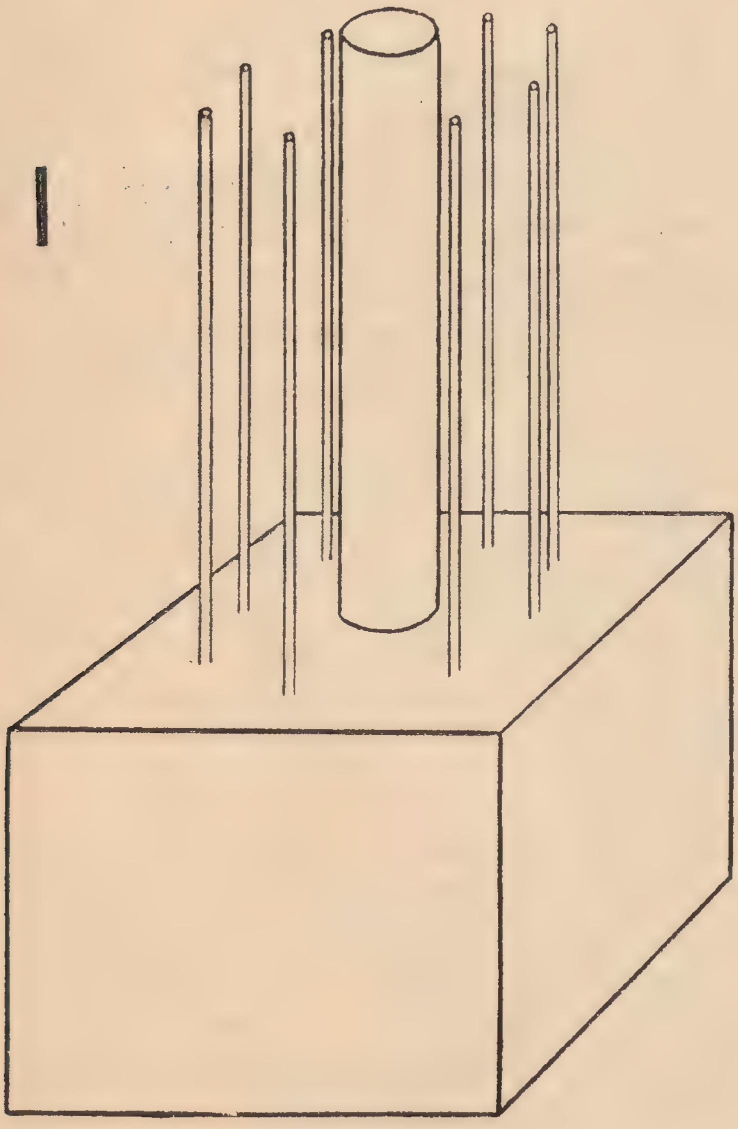
Exp. No.	Snail Species	Tube Section A		Tube Section B	
		Humidity	Number of Snails	Humidity	Number of Snails
		%		%	
1	*H. caperata* *T. striolata*	94	3 3	45	3 3
2	*H. caperata* *T. striolata*	100	6 2	40	3 2
3	*H. caperata* *T. striolata*	100	3 2	45	3 2
4	*H. caperata* *T. striolata*	100	2 3	35	2 3

Owing to shortage of time, no more critical test could be conducted; but the results indicate that these snails are not appreciably affected by humidity differences, and certainly show no significant difference in behaviour between the two species. The former conclusion is in agreement with the results obtained by Dainton (3) working on slugs.

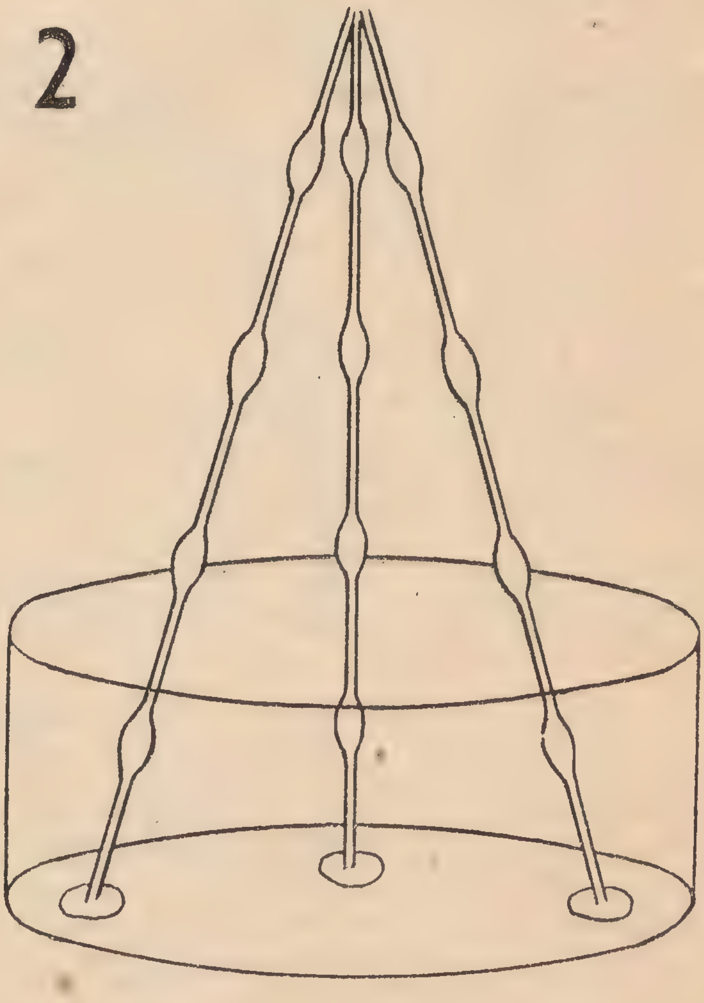
A second theory tested was that the distribution was due to the shape of the leaves as such. Preliminary experiments indicated that this was probably at least part of the explanation and therefore two sets of more critical experiments were devised and carried out.

In the first set the aim was to see whether, given a choice of broad and narrow surfaces to crawl on, the snails would show any preference for one or the other. In designing the apparatus use was made of the marked negative geotropism of the snails. Fig. 1 shows the apparatus, consisting of a wooden block into the top of which was let a vertical closed glass cylinder 1 inch in diameter, representing the broad surface. Around this, at intervals of about $\frac{1}{2}$ inch from the central cylinder and from each other, was set a circle of narrow glass rods $\frac{1}{8}$ inch in diameter, representing a narrow surface. The whole was coated with bakelite varnish to give a uniform surface. The snails were introduced at the base of the rods and cylinder, care being taken to ensure that they had equal opportunities of finding either a rod or the cylinder to ascend. Snails ascending to the top of either rod or cylinder were counted as accepting this. Rejections were recorded when the animal, having tested a rod or the cylinder, either remained on the base and continued searching for a more suitable surface, or transferred from broad to narrow (or vice

1



2



versa) across the intervening gap. The results of a series of observations are given in Table III.

TABLE III.

CHOICE OF BROAD AND NARROW GLASS RODS BY *H. caperata* AND *T. striolata.*

Snail Species	Broad Surface Cylinder			Narrow Surface Cylinder		
	Acceptances	Accept and Settle on	Rejections	Acceptances	Accept and Settle on	Rejections
T. striolata	12	3	2	7	1	14
H. caperata	5	1	4	11	10	0

Though the results are somewhat few in number, they indicate that, under the conditions of the above described experiment, both *T. striolata* and *H. caperata* can detect differences in the shape of the surfaces they crawl on and that such differences may be capable of influencing their distribution. In the former case the preference appears to be for broad surfaces and in the latter for narrow ones.

The second set of experiments was devised in order to find whether the shape of the surface had any effect on the " settling reaction " of the two species, as distribution in the field might conceivably result from combination of locomotor and settling responses. Again, use was made of the negative geotropism shown by both species.

Three long glass rods were prepared, consisting of alternating narrow sections (diameter 0·6 cm.) and broad sections (diameter 2·6 cm.). As shown in Fig. 2, these glass rods were set up in a shallow dish containing a layer of water to prevent the escape of the snails. The snails were placed on the platform at the base of the rods and left for 15 minutes to enable them to ascend the rods and settle down. The numbers of each species on broad and narrow sections were then counted. Several experiments were conducted, fresh snails being used on each occasion. The combined results are given in Table IV.

TABLE IV.

DISTRIBUTION OF *T. striolata* AND *H. caperata* ON BROAD OR NARROW SECTIONS OF GLASS RODS.

Snail Species	Number on Broad Sections	Number on Narrow Sections	Number of Snails divided by :—	
			(*a*) Area of Broad Sections	(*b*) Area of Narrow Sections
H. caperata .	41	92	0·066	0·43
T. striolata .	73	48	0·120	0·22

These results show a preference for settling on narrow stems on the part of *H. caperata*. The results for *T. striolata* are not so clear, but perhaps more experiments might lead to their elucidation. It is not certain whether it is the area or the relative length of the segments which is of crucial importance in this experiment. If the former is the case, as assumed here, it appears that *T. striolata* settles down more readily on narrow than on broad stems, though the preference is much less marked than that of *H. caperata*. It would seem that the "settling reaction" is of little importance in determining the field distribution of *T. striolata*, but possibly of considerable importance in determining that of *H. caperata*.

The results obtained, although they have not been carried to a conclusion, are of interest in pointing the way to possibly fruitful lines of research, both as regards the factors determining the distribution of these snails and the neuro-muscular and sensory mechanisms which are the basis of the "settling reaction".

SUMMARY.

1. Field observations showed the occurrence of *H. caperata* on narrow-leaved plants and of *T. striolata* on broad-leaved ones.

2. This association is probably not conditioned by humidity which, within wide limits, does not affect the behaviour of the snails under laboratory conditions.

3. Experiments demonstrated the preference of *H. caperata* for crawling and settling on narrow surfaces and of *T. striolata* for crawling on broad surfaces, but, if anything, for settling on narrow surfaces.

We wish to acknowledge our indebtedness to Dr. G. Salt and Dr. J. A. Ramsay for their generous help and advice.

REFERENCES.

(1) Ellis, A. E., 1926. *British Snails*, Oxford.
(2) Gunn, D. L., 1937. Humidity Reactions of the Woodlouse *Porcellio scaber* (Latreille), *J. Exp. Biol.*, **14**, 178.
(3) Dainton, B. H., 1943. Effect of air currents, light, humidity and temperature on slugs. *Nature*, **151**, 25.

On the alleged occurrence of Circulus in Cornwall.—Mr. A. P. Gardiner has recorded the occurrence of *Circulus striatus* (Philippi) from Cornwall in this *Journal* (*22*, 1945, 148). I am convinced that the identification is wrong, and asked him to correct the error; but, as he unfortunately lost the shell I sent him, on which the determination was based, he has left it to me to publish a correction. The first two specimens, including the one recorded, I found in weed washings below Lestowder Cliff, Gillan Creek. I subsequently obtained more and better specimens in weed washings from Gwyllyngrase, Falmouth. I am now convinced that all the specimens are young shells of *Gibbula umbilicatus* (da Costa). The characters of *Circulus* as given by Jeffreys (*British Conchology*, *3*, 315) are quite clear, and I have no doubt that all these small shells are young *Gibbula* and that the record of *Circulus striatus* from Cornwall should be expunged.

T. G. W. Fowler.

POSSIBLE BIOLOGICAL RACES IN *HYDROBIA ULVÆ* (PENNANT) AND THEIR VARYING RESISTANCE TO LOWERED SALINITY.

By Nora Fisher McMillan.

Some years ago I made some experiments with a view to finding out just how great a dilution of seawater *Hydrobia ulvæ* would tolerate and, as the results proved rather interesting, details are given in the following account.

Animals from three localities were used in an attempt to ascertain the salinity range of *H. ulvæ*, and it will be convenient to deal with those from each locality separately.

Locality A.—The Kinnegar, Holywood, Co. Down. For this material and for the field observations I am greatly indebted to Mr. R. MacDonald. The snails were collected 6 October 1935 from a brackish ditch inside an embankment made to reclaim land. The ditch contained a flora of *Chætomorpha crassa* Kutz., *C. linum* Kutz., a little *Ulva lactuca* L., and *Enteromorpha* sp., together with many Diatoms on the bottom. The fauna included the following: Crustacea: *Sphæroma rugicauda* Leach, *Idotea viridis* Slabber, *Jæra albifrons* Leach, *Gammarus duebeni* Lilljeborg, *Corophium grossipes* (L.), *Praunus flexuosus* (Müller), *Neomysis vulgaris* J. V. Thompson, *Palæmonetes varians* (Leach), *Carcinus mænas* (Pennant); Mollusca: *Hydrobia ulvæ* (Pennant), *Littorina saxatilis* (Olivi); Annelida: *Arenicola* (castings); *Nereis* sp. (probably *diversicolor* O. F. Müller); and the stickleback, *Gasterosteus aculeatus* L.

Forty *H. ulvæ* were taken and transferred at regular intervals to water containing a diminishing proportion of seawater. On the eighteenth day the snails were placed in a mixture of 22 per cent seawater and 78 per cent fresh water. For the first few minutes they were active and then withdrew into their shells and remained inactive. Five days later 37 out of the 40 were dead.

Locality B.—Cheshire shore of the Dee, between West Kirby and Thurstaston; collected 8 September 1935; specimens numerous, rather small; shore sand, with mud. About 50 animals were used and the salinity of the water in which they were kept was gradually lowered, until at the end of the fourteenth day they were active in a mixture of 25 per cent seawater and 75 per cent fresh water, but on being transferred to 22 per cent seawater they withdrew into their shells and remained inactive. On the twentieth day six were dead, the remainder revived when placed in fresh seawater, but remained inactive when returned to the mixture of 22 per cent seawater and 78 per cent fresh water.

Locality C.—Burton Marsh, Cheshire; collected 8 September 1935; specimens large and light-coloured. Habitat, shallow pools and gutters at the top of the zone occupied by *H. ulvæ*. Flora: diatoms abundant on mud at bottom of pools and gutters, no other algæ, but the grass *Festuca rubra* L. abundant around and often in the pools. *Corophium* sp. was abundant in the *H. ulvæ* pools.

About a hundred animals were used, and by the twenty-first day the percentage of seawater in the mixture in which they were living had been reduced to 20. In this they behaved normally, and further reduction of the proportion of seawater to fresh water down to 7·5 per cent seawater and 92·5 per cent fresh water found *H. ulvæ* still active on the fortieth day. On the forty-first day they were transferred to a mixture of 5 per cent seawater and 95 per cent fresh water, but this proved to be the limit of their endurance to low salinities and on the forty-second day all were dead save two.

The difference in the resistance to lowered salinity is striking and may perhaps be correlated with the different conditions under which the animals lived in their original habitats. The Holywood ditch has seawater percolating into it and a certain amount enters by the valves, but on the whole it appears to vary little in salinity. The fact that the Holywood *H. ulvæ* proved the least adaptable to changing salinity fits in well with the known conditions under which the animals normally live.

In the West Kirby locality the animals are influenced by the waters of the River Dee which modify in a varying degree the salinity of the water entering the estuary. This suggests a fairly high degree of adaptability, which is borne out by the result of the experiment.

The Burton Marsh pools and gutters, by reason of their position in a wide expanse of salt-marsh, are exposed to widely varying conditions of salinity. As Nicol (1935) says : " Every tide and every shower of rain alters the composition of the water in the pools, which may pass from a polyhaline to an almost oligohaline condition in a few days, so that only animals which are able to withstand the whole range of salinities for an appreciable time will be able to survive permanently in the small pools of a salt-marsh." The fact that the Burton Marsh *H. ulvæ* were by far the most resistant to lowered salinity confirms this.

Nicol (1936) in her work on the brackish lochs of North Uist found that the salinity range of *H. ulvæ* was from 10 to 34 promille, while Johansen found in the Randers Fjord that the range was from 1 to 24 promille. Ellis (1932), in the Adur Estuary, Sussex, found that *H. ulvæ* lived in water of a salinity varying from 13·7 to 34·7 promille. But the surprising difference in salinity range between *H. ulvæ* from two localities lying only nine miles distant from one another seems to be explicable only by the supposition that there exist, within the species, distinct biological races. The results of the experiments correspond well with what one would expect ; i.e. the least adaptable of the " races " live in the most stable (comparatively speaking) environment, and the most adaptable in the environment where conditions vary widely and frequently.

The seawater used in the experiments was obtained from outside Liverpool Bar and, assuming that the salinity was approximately 35 promille, the results may be tabulated thus :—

Holywood specimens : died in 22 per cent seawater (salinity approximately 7·7 promille).

West Kirby specimens : " dormant " but alive in 22 per cent seawater (salinity approximately 7·7 promille).

Burton Marsh specimens : behaved normally in 22 per cent down to 7·5 per cent seawater ; died in 5 per cent seawater (salinity approximately 0·26 promille).

REFERENCES.

ELLIS, A. E., 1932. The Habitats of Hydrobiidæ in the Adur Estuary, *Proc. Malac. Soc.*, **20**, 11–18.

JOHANSEN, A. C., 1918. *Randers Fjord Naturhistorie.* Copenhagen.

NICOL, E. A. T., 1935. The Ecology of a Salt-Marsh, *J. Mar. Biol. Assoc. U.K.*, **20**, 203–261.

—— 1936. The Brackish-water Lochs of North Uist, *Proc. Roy. Soc. Edinburgh*, **56**, 169–195.

THE RESISTANCE OF *HYDROBIA VENTROSA* (MONTAGU) TO LOW SALINITIES.

By NORA FISHER MCMILLAN.

SOME years ago I made some experiments to ascertain the salinity range of *Hydrobia ventrosa* (Montagu) and *Hydrobia ulvæ* (Pennant), with interesting results. The following note deals only with *Hydrobia ventrosa.*

Sixty living specimens were used, obtained from a salt-marsh gutter on Larne Lough, Co. Antrim, 10 May 1936. The bottom of the gutter was soft fine mud, with no macroscopic algæ. The crustacean *Corophium grossipes* (L.) was very common, and the only other mollusc noted was *Hydrobia ulvæ*, which was scarce.

On 14 May the snails were divided into two lots of 30 each, and each placed in a glass dish holding rather less than half a pint. Lot *A* (Controls) were placed in seawater ; Lot *B* in a mixture of 90 per cent seawater and 10 per cent fresh (tap) water. The dishes were kept side by side in a cool room, not exposed to direct sunlight.

By 8 June (i.e. in 25 days) the salinity of the water of Lot *B* had been reduced to 70 per cent seawater by 5 per cent stages. In 70 per cent seawater and 30 per cent fresh water all were alive and active. But on transferring them to a mixture of 65 per cent seawater and 35 per cent fresh water all remained inert and three days later they were all dead, while only two of Lot *A* (Controls) had died.

The obvious conclusion to be drawn from this experiment is that under artificial conditions *H. ventrosa* requires a minimum salinity of approximately 24·5 promille. A. E. Ellis (1932) working on the ecology of the species in the Adur estuary at Shoreham, Sussex, found *H. ventrosa* to inhabit " practically pure seawater (2·49 NaCl) and associated with a marine fauna ".

In North Uist, Miss Nicol (1936) found *H. ventrosa* common in the brackish lochs and in one (Loch Obisary) in a minimum salinity of 10·4 promille. Clearly another factor in addition to salinity is involved here, as in six other North Uist lochs described *H. ventrosa* occurs in salinities down to 24 promille, thus agreeing well with Ellis' observations and my experiment.

REFERENCES.

ELLIS, A. E., 1932. The Habitats of Hydrobiidæ in the Adur Estuary, *Proc. Malac. Soc.*, **20**, 11–18.

NICOL, E. A. T., 1936. The Brackish-water Lochs of North Uist, *Proc. Roy. Soc. Edinburgh*, **56**, 169–195.

WALLACE'S LIST OF ORKNEY MOLLUSCA.

By R. RENDALL.

BEFORE his death in 1688 the Rev. James Wallace, minister of Kirkwall, prepared at the request of Sir Robert Sibbald, M.D., geographer to King Charles II, a *Description of the Isles of Orkney*. This was published by his son, James Wallace, M.D., F.R.S., in the year 1693. This original edition contained a summary of the natural history of the islands, including observations on marine life. Reference is made to oysters, mussels, the "*Tellinæ*", cockles, "*Echinus Marinus*," starfish, "tangles full of shells," the "Camshells, or *Os-sepia*", the "*Concha Anatifera*" (*Lepas anatifera*) which is figured in a plate, and to that marine form "which Gesner calls *Penna Marina Sitardi*", besides fishes and other seashore creatures. He also speaks of "A great snail that hath a bright white stone growing in it". This all indicates that the father had more than a cursory interest in marine life, though there is no actual record of his having compiled a formal catalogue of Orkney species.

A second edition of the *Description*, with additional "Illustrative Notes", was published in 1700 by the son, under the title *An Account of the Islands of Orkney*, but in it no mention is made of the father's labours. The "Illustrative Notes" contain, among other matter, two lists, one of the Land Plants and the other of the Mollusca found in Orkney. These lists are generally attributed to Dr. James Wallace, probably rightly so. The introductory notes to the lists imply that the son is the author, and make mention of acquaintance with the works of Martin Lister, a fellow physician and F.R.S. But we should note that some descriptive phrases in the list of Mollusca are taken from the shorter notice written by the father. On the other hand, a plate in the 1700 edition, corresponding to one in the original, has figures of *Chlamys distorta* and *Lepidochiton cinereus* added. The probability is that the son followed up an interest which had been the father's and carried it on to more scientific perfection.

Since writing the foregoing I have seen the manuscript of that part of the additional notes containing the Orkney Flora. This has on the cover page a short note on medical treatment, in the same handwriting as that of the list of plants, which therefore is presumably the work of Dr. Wallace himself. The writing, moreover, is quite distinct from that of the Rev. James Wallace, one of whose autograph letters I have also been able to examine. This seems to put beyond question the attribution of the list to Dr. James Wallace, and we may safely assume that the list of Mollusca falls into the same category.

In compiling his list Dr. Wallace adopted the contemporary method of defining species by more or less extended descriptions in Latin, whose precise equivalents in our modern binomial forms are somewhat difficult to determine. But through the kind interest of Mr. J. R. le B. Tomlin the list came under the eye of Mr. R. Winckworth, whose specialized knowledge of systematic nomenclature has enabled him to identify all the species. For his ready and expert assistance I render grateful and due acknowledgment. The list, as prepared by him and presented here, condenses, in the first column, the more extended descriptions used by Wallace.

Later marine zoologists have added to the known local species, notably those whose Orkney records, mostly derived from dredging, are incorporated in Forbes and Hanley's monograph, among whom may be mentioned McAndrew and Captain Thomas. Their work in turn has been supplemented by still later collectors, Mr. Winckworth himself having compiled a not inconsiderable list of species new to the islands or hitherto only doubtfully recorded. But this early Wallacean list claims special interest, being—so far as I can ascertain—the first list of shells indigenous to our Orkney shores.

The phrases describing the shells of Orkney in this work are mostly taken from Lister's *Animalium Angliae tres tractatus*, 1678, here referred to by "A", followed by the number of the "titulus" and figure of the species. "Syn" refers to *Synopsis Methodica Conchyliorum*, 1685.

Buccinum rupium	A (terr.) 8	*Zua lubrica* (Müller).
B. exiguum	A (fluv.) 25	*Lymnæa peregra* (Müller).

COCHLEÆ MARINÆ.

Buccinum album	A 1	*Neptunea antiqua* (L.).
B. crassum	A 2	*Buccinum undatum* (L.).
B. tenue, læve	A 3	*Buccinum undatum* var. *striata* Pennant.
B. bilingue	Syn. 865	*Aporrhais pespelecani* (L.).
B. angustius	A 4	*Colus gracilis* (da Costa).
B. minus	A 6	*Nucella lapillus* (L.).
B. tenue, dense	A 8	*Turritella communis* Risso
Cochlea fusca	A 9	*Littorina littorea* (L.).
C. rufescens	A 10	*Natica catena* (da Costa).
Nerita ex fusco	A 11	*Littorina littoralis* (L.).
N. fasciatus	A 12	*Littorina littoralis* var. *zonata* Menke.
N. reticulatus	A 13	*Littorina littoralis* var. *reticulata* Dautz.
Trochus albidus	A 14	*Calliostoma zizyphinum* (L.).
T. crebris	A 15	*Gibbula cineraria* (L.).
T. minor	—	*Margarites helicinus* (Fabricius).
Concha Veneris	A 17	*Trivia arctica* (Montagu).
[Echinus marinus	A 18	*Echinus esculentus* L., Echinoderma.]
Patella ex livido	A 40	*Patella vulgata* L.
P. fusca	—	*Patella vulgata* var. *secernenda* Dautzenberg.
P. articulata	—	*Lepidochiton cinereus* (L.).
P. minor	—	*Patina pellucida* (L.).
P. ovalis	—	*Acmæa tessulata* (Müller).
P. maxima	—	*Patina pellucida* var. *lævis* (Pennant).
Ostreum	A 26	*Ostrea edulis* L.
Concha longa	A 19	*Lutraria lutraria* (L.).
C. quasi	A 20	*Venerupis pullastra* (Montagu).
C. e maximis	A 22	*Cyprina islandica* (L.).
C. tenuis	A 23	*Arcopagia crassa* (Pennant).
C. crassa	A 24	*Spisula subtruncata* (da Costa) no doubt: but Lister figures *S. solida*.
C. parva	A 25	*Macoma balthica* (L.).
Pecten maximus	A 29	*Pecten maximus* (L.).
P. tenuis	A 30	*Chlamys opercularis* (L.).
P. minimus	A 31	*Chlamys distorta* (da Costa).
P. minor	—	*Chlamys tigerina* (Müller).
P. from Stroma	—	*Chlamys distorta* (da Costa).

Pectunculus minus concavus	A 32	*Laevicardium crassum* (Gmelin).
P. albus	—	*Cardium ovale* (Sowerby).
P. subfuscus	Syn. 272	(108) This figure represents the same shell figured in A 22, i.e. *Cyprina islandica*, listed above.
P. echinatus	—	*Cardium echinatum* L.
P. vulgaris	A 34	*Cardium edule* L.
Tellina	A 35	*Donax vittatus* (da Costa).
Concha laevis	A 36	*Mya truncata* L.
Solen	—	*Ensis siliqua* (L.).
Musculus	A 28	*Mytilus edulis* L.
[Balani Rondeletij . .	—	*Lepas anatifera* L., Crustacea.]
[Balanus cinereus . . .	A 41	*Chthamalus stellatus* (Poli), Crustacea.]

No doubt in some cases several species have been included in one description, e.g. *Balanus balanoides* would be included with *Chthamalus stellatus*, *Natica poliana* with *N. alderi*, etc. Still there are some unexpected omissions of common Orkney species, e.g. *Lacuna vincta*, *L. pallidula*, *Tellina tenuis*, *Dosinia*, *Mya arenaria*.

OBITUARY NOTICES.

T. D. A. COCKERELL, 1866–1948.

THEODORE DRU ALISON COCKERELL was born at Norwood, Surrey, 22 August 1866 and died at San Diego, California, 26 January 1948. He was the eldest son of Sydney John Cockerell of Beckenham, and grandson of George Cockerell, a London coal merchant. His mother, Alice Elizabeth, was the daughter of Sir John Bennett, the well-known watchmaker of Cheapside. He was educated at a private school and at Middlesex Hospital Medical School; he was an honorary D.Sc. of Colorado College and of Denver University and Professor of Zoology at Colorado University. He became a naturalized American citizen in 1898, and was elected a member of the Conchological Society in 1921.

Cockerell was very interested in slugs and published many papers thereon in various scientific periodicals. His " Check-list of the Slugs " appeared in *The Conchologist*, 2, 1893, and " A Revised List of the Species of British Slugs " in this *Journal*, 7, 1892. He was a prolific writer of notes on Mollusca and as he travelled widely had many observations to record. Later he devoted much of his time to the study of bees, and in 1946 wrote : " I have been working on African bees : published 41 species of African *Halichus* in 1945. But to my regret I find no opportunity to work on Mollusca." Mr. Tomlin writes : " He was a great advocate and coiner of so-called varietal names and for a short time tried to found the expression ' varietas animalis ' for colour forms of the soft parts, admitting distinct varietal names for shell and for animal."

Cockerell took charge of the Desert Museum, Palm Springs, while Lloyd Smith, the Director, was away on war service, until February 1946. In 1891 he married Annie S. Fenn, daughter of G. Manville Fenn. She died in 1893. In 1940 he married Wilmette Porter, of Iowa.

A. S. KENNARD, 1870–1948.

ALFRED SANTER KENNARD, who died at Beckenham on 11 June 1948, came of Kentish stock but was born in London (5 July 1870), where he lived and worked all his life. He was educated at the City of London School and then became employed in a large City warehouse, remaining there until his retirement and surviving its complete destruction by German bombs. Without any academic training, he acquired his knowledge of living things in the best of all ways, by companionship with those, young and old, of like interests. With a strong leaning towards the antique—old books, ancient buildings, obsolete customs, primeval men—it was no wonder that he was attracted to the study of those long departed lives so well represented around London by fossil Mollusca. Rightly to know the remains of the dead one must understand the living, so he combined an active membership of both Geological and Conchological Societies, becoming a life member of the latter in 1897. His earlier life was in a time when the great antiquity of man was almost an enthralling novelty, not asserted as a dogma but supported by proofs, like the occurrence in the gravels left by an earlier Thames, when it flowed 100 feet above its present level, of human artefacts associated with bones and shells of extinct animals. The Mollusca of these Pleistocene and Holocene deposits became his lifelong study, recorded in numerous papers and in appendices to the labours of others. Things are hardly distinguished until they are named, but here one enters very thorny, tortuous thickets. Kennard, in long association with B. B. Woodward, laboured hard at the nomenclature of our land and freshwater mollusca, their conclusions being published in 1926 by the British Museum (Natural History) as a *Synonomy of the British Non-Marine Mollusca* (*Recent and Post-Tertiary*). What to many would have been a distasteful, dry as dust search through forgotten volumes became Kennard's delight by his love for old books, especially when they had been personally bought for a few pence on London book barrows. Like most genuine searchers for a knowledge of nature, he was glad to impart it; this was evident in his Presidency of the London branch of our Society, where a small band gathered to exhibit and discuss their collections.

Living to a reminiscent old age, he became a valuable repository of the traditions of our study and a link with the gone but not forgotten collectors and students of a past generation. He was our President in 1927–28 and presided over the Malacological Society in 1922–25 and over the Geologists' Association in 1944–46. He was honoured by receiving the Prestwich Medal of the Geological Society of London and the Foulerton award of the Geologists' Association, and by being elected an Associate (*honoris causa*) of the Linnean Society.

Complementary notices will appear in the *Proceedings* of the Geologists' Association and of the Malacological Society. The latter has Kennard's portrait as a frontispiece to volume 18 (1928), which well expresses a kindly, humorous and thoughtful man.

A. WRIGLEY.

A. J. PEILE, 1868–1948.

ALFRED JAMES PEILE was born on 5 August 1868 at Harley Road, London, N.W., and died in St. Thomas's Hospital on 30 July 1948. He was the only son of James Kenyon Peile, civil engineer, and Matilda Chadwick. After passing through Cheltenham College and the Royal Military Academy, Woolwich, he was commissioned in the Royal Artillery on 17 February 1888. He served abroad in India, Bermuda and South Africa, and at home in the School of Gunnery at Shoeburyness. During the 1914–18 war he saw service with the heavy artillery in France and at siege artillery schools at Lydd and Borden, being placed on the retired list with the rank of Lieutenant Colonel in 1920. In 1896 he visited Ceylon and Australia, and from 1920 to 1940 was an honorary worker in the department of Mollusca at the British Museum (Natural History). Peile married in 1894 Marion Macdonald Peterson, daughter of Dr. Peter Peterson, Professor of Sanskrit, Elphinstone College, Bombay. They had one son, who was killed in action in France in 1917, and three daughters.

Peile was elected a member of the Conchological Society in 1921 and was President from 1935 to 1937. All his work on Mollusca was very good and his determination of species most careful and reliable. He prepared a well displayed collection of Bermudan shells which was shown at the Wembley Exhibition in 1924, and he formed a representative collection of land shells and shells of Bermuda and Bombay. It is, however, as an expert on radulæ, in the preparation of which he achieved a perfection of technique, that Peile will be chiefly remembered. The majority of his published papers treats of radulæ, including his presidential address, "Some Radula Problems" (*J. Conchol.*, *20*, 1937, 292–304). His presidential address to the Malacological Society on "The Mollusca of Bermuda" (*Proc. Malac. Soc.*, *17*, 1926, 71–98) includes a list of the recent Mollusca of the island. Among papers not concerned with radulæ are notes on fossil and recent *Poecilozonites* from Bermuda, the genus *Indoennea*, Clausiliidæ, *Macrochlamys* and various other land shells. Since his retirement from the Army he published over 50 papers, a list of which has been prepared for the *Proceedings of the Malacological Society.*

H. C. WINCKWORTH, 1878–1947.

HAROLD CHARLES WINCKWORTH was born on 13 August 1878, the second son of a Brighton surgeon, Charles Trew Winckworth, and of Alice, née Braby, both from Horsham, Sussex. He was educated at Epsom College and, after apprenticeship to a Brighton dentist, went to Guy's Hospital, 1898–1903, qualifying as M.R.C.S., L.R.C.P. and L.D.S. After a year as house surgeon and anæsthetist in the Sussex County Hospital he was commissioned in the R.A.M.C. in 1904. While on service in Malta he was sent to Calabria on rescue work after the Messina earthquake of December 1908, for which he received the order of Officer of the Crown of Italy and the medal of the Red Cross of Italy. He was mentioned in despatches for service in the third Afghan War, 1919, and also saw service in the Mesopotamia campaign of 1916. He was senior surgeon in the Rhine Army in 1921-22 and then returned to India, serving at Bangalore, in charge of hospitals at Calcutta, Wellington and Karachi, and as A.D.M.S., Meerut District. He had been gazetted Lieutenant Colonel in 1927 and Colonel in 1933 and retired in 1935. Towards the end of his service he was honorary surgeon to the Viceroy. He offered his services in 1939, which were not accepted until 1941, when he was given charge of the Colaba Hospital at Bombay: he next organized the Officers' Convalescent Depot at Poona, and retired a second time in 1944.

Among his enthusiasms were games, especially lawn tennis, in which he won many prizes and represented the British Army of the Rhine against France. In music he achieved a high standard of execution on the 'cello and his fondness for chamber music incidentally brought him in contact with the Duke of Connaught in Malta and with Yates in India.

Natural history attracted him from Epsom days. In 1924 the collection of Indian butterflies began, continued later with J. A. Yates of the education service. A fully representative collection, including local and seasonal forms, of all South Indian butterflies was made: the final series, thinned down from over 20,000 recorded specimens, was presented to the Hope department of Oxford University Museums. The chief discovery was the habitat and habits of *Parantirrhoea*: this and other results were written up by J. A. Yates in the *Journal of the Bombay Natural History Society*. Smaller collections were made in the Andaman Islands and elsewhere.

In 1911 an early interest in shells revived and he began to collect British marine molluscs on shore and by dredging from Shetland to the Channel Islands. This was the beginning of the Winckworth collection, which with the Mason collection added went to Liverpool Public Museums (see this *Journal*, *21*, 1940, 186), where it was largely destroyed by enemy action in May 1941.

In 1924 the collection of Indian shells began, gathering impetus as the butterfly collection neared completion. Among the many shore localities explored were Karachi, Bombay, Goa, Tellicherry, Quilon, Cape Comorin, Tuticorin, Pamban, Madras, Waltair, Puri: and in Ceylon, Galle, Trincomali and the Pearl Banks. Three visits to the Andaman and Nicobar Islands produced excellent results. Collections were also made in Zanzibar, Port Sudan, Muscat and Singapore. He first visited the Seychelles in 1936, again in 1937 and in 1938, when he bought a house, Thanksgiving, in North West Bay, Mahé. Here he made the most thorough of all his collections: from 1937 onwards nudibranchs became the principal subject of study. His skill in shore collecting was remarkable and he trained his house servants to collect well too: it was a delightful experience to go out on the reef with him, full of enthusiasm, while the house boy was perhaps searching for *Terebra* and dorids with a water telescope and the cook was finding eolids and other small molluscs. He was entering notes and extracting radulæ up to a few days before the end, when he died of thrombosis in the Seychelles Hospital on 23 October 1947.

He wrote little for publication, but left detailed notes, often with drawings of animal and radula, on about 2,000 specimens. He hoped that an account of the whole nudibranch fauna, over a hundred species, of the Seychelles Islands would eventually be ready for printing.

BIBLIOGRAPHY

1923. Dredging in Loch Alsh. *J. Conchol.*, **17**, 65.
1935. *Eastonia rugosa* and other Portuguese Mollusca. *J. Conchol.*, **20**, 162.
1940. Catalogue of the marine Mollusca of the Seychelles. In J. T. Bradley, *The History of Seychelles*, **2**, Appendix.
1946. *Glossodoris* from Bombay. *Proc. Malac. Soc.*, **26**, 155.
1946. A new *Goniodoris* from Bombay. *Proc. Malac. Soc.*, **27**, 59.

R. WINCKWORTH.

Balcis devians (Monterosato) on a sea-urchin.—A common sea-urchin, *Paracentrotus lividus* (Lamarck), abounds in the rock pools exposed at low tide at Saint-Jean-de-Luz. On examining the sea-urchins I found some 40 specimens of *Balcis devians*, one of the species to which the name *Eulima distorta* has been applied. The *Balcis* usually occurred singly, though in a few instances two were found on one sea-urchin and in one instance three ; no living example was found except on *P. lividus*. Mr. R. Winckworth has kindly verified the determination of *B. devians*.

BARTHOLD S. KISCH.

Bithynia tentaculata (L.) in closed ponds.—Since my previous note on this subject (*J. Conchol.*, *22*, 1946, 214), Mr. Thurgood has sent me some interesting notes on his experience of the species in Yorkshire, extending over 50 years. He says he has on many occasions taken *B. tentaculata* in closed ponds, and cites the following localities : Mosely Wood Bottom, Horsforth, v.-c. 64, 17 October 1947 ; Shirley Pool, Askern, v.-c. 63, 25 June 1938 ; Carlton, East Riding, v.-c. 63, 8 September 1946, *B. tentaculata* abundant, with *Planorbis carinatus* Müller, no other Mollusca, pond covered with weed. On the other hand, in the course of an investigation of some 70 old water-filled marl-pits in the Raby-Bromborough districts of Wirral, Cheshire, *B. tentaculata* was not obtained at all.

N. F. McMILLAN.

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Communications intended for publication in the *Journal*, and specimens of non-marine Mollusca for the Society's Census, should be sent to A. E. Ellis, Epsom College, Surrey. Slugs and *Succinea*, if possible alive, otherwise preserved in 70 per cent alcohol, should be sent to Dr. H. E. Quick, 130 Eaton Crescent, Swansea. When sending specimens for authentication it is a great help if the name and number of the vice-county are given, as well as the exact locality. Marine Mollusca should be sent to Mr. A. P. Gardiner, Kiln Coppice, Bradfield, near Reading.

Conchological Notes from Scotland.—A correspondent of mine, Mr. W. Ramsden of Manchester, has from time to time submitted shells for verification, and it occurred to me that one or two items are worthy of record. When at Ben Lawers, Perthshire, on 7 July 1944 he found a very small form of *Arianta arbustorum* (L.) at about 3,200 feet, a little above the col between Ben Lawers and the mountain next to the west. The rock is mica-schist and there were several uncommon plants, such as *Draba rupestris* and *Salix reticulata*, growing on the rocky ledge where the snails were found. He had previously noted the species at 1,600 feet on Ben More near Crianlarich, Perthshire, on rather boggy heathery ground, and at about 6,500 feet on the Cima della Rosetta in the Dolomites.

Mr. Ramsden also found two specimens of *Clausilia bidentata* (Ström) at 2,250 feet on the mica-schist cliffs immediately west of Lochan na Lairig, a few miles west of Ben Lawers, living amongst the stems and rootlets of *Silene acaulis* (28 June 1947). *Columella edentula* (Drap.) was also found on Ben Lawers at 3,350 feet on *Arenaria rubella*, one of the choice rareties of this botanist's Mecca (5 July 1947).

While in South Uist during September 1946 Mr. Ramsden came across the vertebra of a whale which had been thrown up on the *machair* near the west shore of the island. On this bone were several specimens of *Vertigo pygmæa* (Drap.), and under it *Cochlicopa lubrica* (Müll.) and *Vitrina pellucida* (Müll.). He also visited the small island of Eriskay off the south end of South Uist, and on rocks and boulders 10 to 20 feet above the shore at the north end of Prince's Strand (the place where Prince Charlie first landed on Scots soil) found hundreds and hundreds of *Helix aspersa*, mostly about half-grown.

J. Wilfrid Jackson.

Ena montana (Drap.) in Gloucestershire.—Last year Mr. W. Ramsden sent me for verification a specimen of *Ena montana* from Bourton Woods, Gloucestershire, taken by him in 1946. In our *Journal* (*21*, 1939, 156) Boycott suggests that the record for this species in the Dovedale locality requires confirmation. The particular Dovedale is at the lower end of Bourton Woods. Mr. Ramsden tells me that during July and August, 1946, he found several specimens of *Ena montana* on ash trees in one small ash-sycamore wood. Bourton Woods are mainly oak-hazel where there is a reasonable depth of soil; the ash wood is on a steepish stony slope with *Mercurialis perennis*, and the *Ena montana* were found only on trees near the foot of the slope. One specimen also was found on a solitary beech in a higher part of the woods.

J. Wilfrid Jackson.

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Kuiper, J. G. J., Nassau Zuilensteinstraat 35, 's-Gravenhage, Netherlands.
Palmer, R. E., 5 Prince Llewellyn Terrace, Dolwyddelen, Carnarvonshire.
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See also Proceedings (page 57).

Corrections to 1947 List.

Initials: F. St. J. Brougham, W. R. Dawson, A. V. Grossu (Timişoara).
Spelling: Dr. Siro Fez y Sanchez.
Delete: W. E. R. Hackett (resigned 1945); D. Keogh (deceased: *Journal*, **22**, 183).
Add: G. H. Richards, F.G.S., 22 Priory Avenue, Hastings, Sussex (elected 1944).

PISIDIUM PSEUDOSPHÆRIUM FAVRE IN ENGLAND.

By J. G. J. Kuiper.

In September 1911 Mr. A. W. Stelfox collected, together with *Planorbis vorticulus*, etc., some *Pisidium* in the moat of Pevensey Castle, East Sussex, which he did not examine until about ten years later, when he at first thought they might be a queer form of *P. milium* or even a minute kind of *Sphærium*. He sent specimens to M. Jules Favre, who suggested they might be a weak form of *P. milium* Held, and although neither Stelfox nor Oldham were quite satisfied, the question was not pursued further owing to insufficient material. In May 1927 Mr. A. E. Ellis and Mr. J. R. le B. Tomlin collected some *Pisidium* in a marsh drain at Pevensey, which Stelfox determined as a depauperate form of *P. milium*, and Mr. R. Winckworth subsequently took further specimens. In the same year Favre (1927, 305, 306, pl. 26. fig. 13) described a *mode* or *forme pseudo-sphærium* of *P. milium*, which he later (1940, 369, 370) called *P. milium* var. *pseudosphærium*. Van Benthem Jutting and Kuiper (1942, 59, pl. 2) gave a description and figures of *P. milium* var. *pseudosphærium* Favre, and it was later redescribed as *P. favrei* by Kuiper (1947, 35, pl. 5).

Mr. Ellis and Mr. Winckworth investigated the Pevensey locality again on 28 May 1948; the *Pisidium* collected on this occasion were all sent to me, and proved to be more or less typical *P. pseudosphærium*, as were the examples collected in 1927 which I received from Mr. Ellis, to whom I am also indebted for the following notes on the habitat.

> The character of the drain where *P. pseudosphærium* was taken in 1927 has altered considerably, having become much overgrown along its banks with hawthorn (*Cratægus monogyna* Jacq.), under the shade of which most of the aquatic vegetation has died out. Mollusca were greatly reduced in numbers; formerly *Planorbis vorticulus* and *Valvata macrostoma* were abundant; now the former is very scarce and the latter present in much smaller numbers. Other species formerly common here, such as *Planorbis vortex*, are also now rare. The exact location of the drain is along the east side of the road from Pevensey to Wartling, close to its junction with the road from Pevensey to Bexhill. The following plants were growing in the unshaded part of the drain where the *P. pseudosphærium* were collected: *Oenanthe fistulosa* L., *Rumex hydrolapathum* Huds., *Elodea canadensis* Michx., *Hydrocharis morsus-ranae* L., *Iris pseudacorus* L., *Sparganium neglectum* Beeby, *Lemna trisulca* L., *L. minor* L., *Potamogeton natans* L., *P. lucens* L., *Carex pseudocyperus* L., *Phragmites communis* Trin., *Equisetum fluviatile* L. The *Pisidium* were most frequent at the roots of *Sparganium*. The following Mollusca were also present: *Valvata cristata* Müller, *V. macrostoma* Mörch, *Hydrobia jenkinsi* Smith, *Bithynia tentaculata* (L.), *B. leachii* (Sheppard), *Physa fontinalis* (L.), *Lymnæa palustris* (Müller), *L. stagnalis* (L.), *L. peregra* var. *ovata* Draparnaud, *Coretus corneus* (L.), *Planorbis planorbis* (L.), *P. vorticulus* Troschel, *P. vortex* (L.), *P. contortus* (L.), *Segmentina complanata* (L.), *S. nitida* (Müller), *Sphærium corneum* (L.).

Since the discovery of this rare *Pisidium* there has been some difference of opinion as to its systematic status. Favre (1927) originally described it as a depauperate form of *P. milium*. At my request M. Favre kindly sent me a good series of the material on which his description was based, together with the associated *P. milium*. I must admit that I should have arrived at the same conclusion if I had only this material at my disposal.

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Amongst this gathering, labelled "Marais de Feuillasse, à Meyrin, pr. Genève", there are some individuals which it is difficult to determine owing to their more or less intermediate shape. Subsequently, however, more data on this *Pisidium* became available.

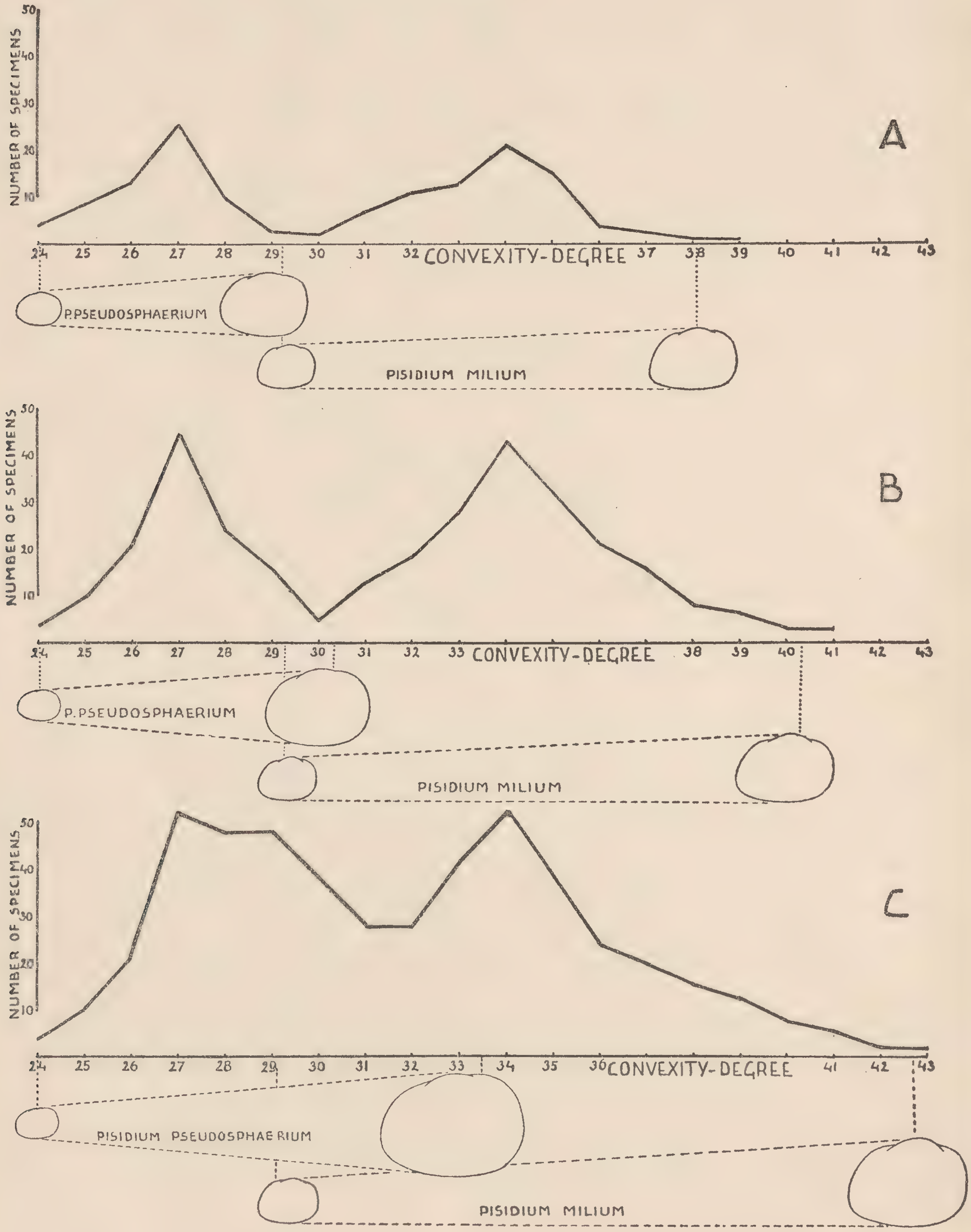

FIG. 1.—Graph showing convexity-degree frequency curves of *Pisidium milium* and *P. pseudosphærium* from the Naardermeer, Netherlands. A. category of shell-length, 1 mm.–1·9 mm.; B. *idem*, 1 mm.–2·2 mm.; C. *idem*, 1 mm.–3 mm. The three curves show partial overlapping of the respective variation amplitudes as a result of increasing convexity of shell during growth.

During the last war I had the opportunity of making malacological investigations in the nature reserve Naardermeer, an extensive swampy territory in the centre of the Netherlands. In 1943–5 I collected here, at more than sixty stations, a total of some two thousand individuals of *P. pseudosphærium*, mostly accompanied by *P. milium*, and other species of this genus. I was able without any difficulty to trace in all these samples the systematic line between *P. pseudosphærium* and *P. milium*. The critical characters are in the first place the shape and sculpture of the shell. The hinge-plate of *P. pseudosphærium* often closely resembles those of thin specimens of *P. milium* and *P. nitidum*. In the Naardermeer *P. pseudosphærium* and *P. milium* vary little, the latter being typically quadrangular, with a glossy surface, coarse irregular striation and more or less prominent umbones, whereas the former is relatively higher, more oval and flattened and finely striate.

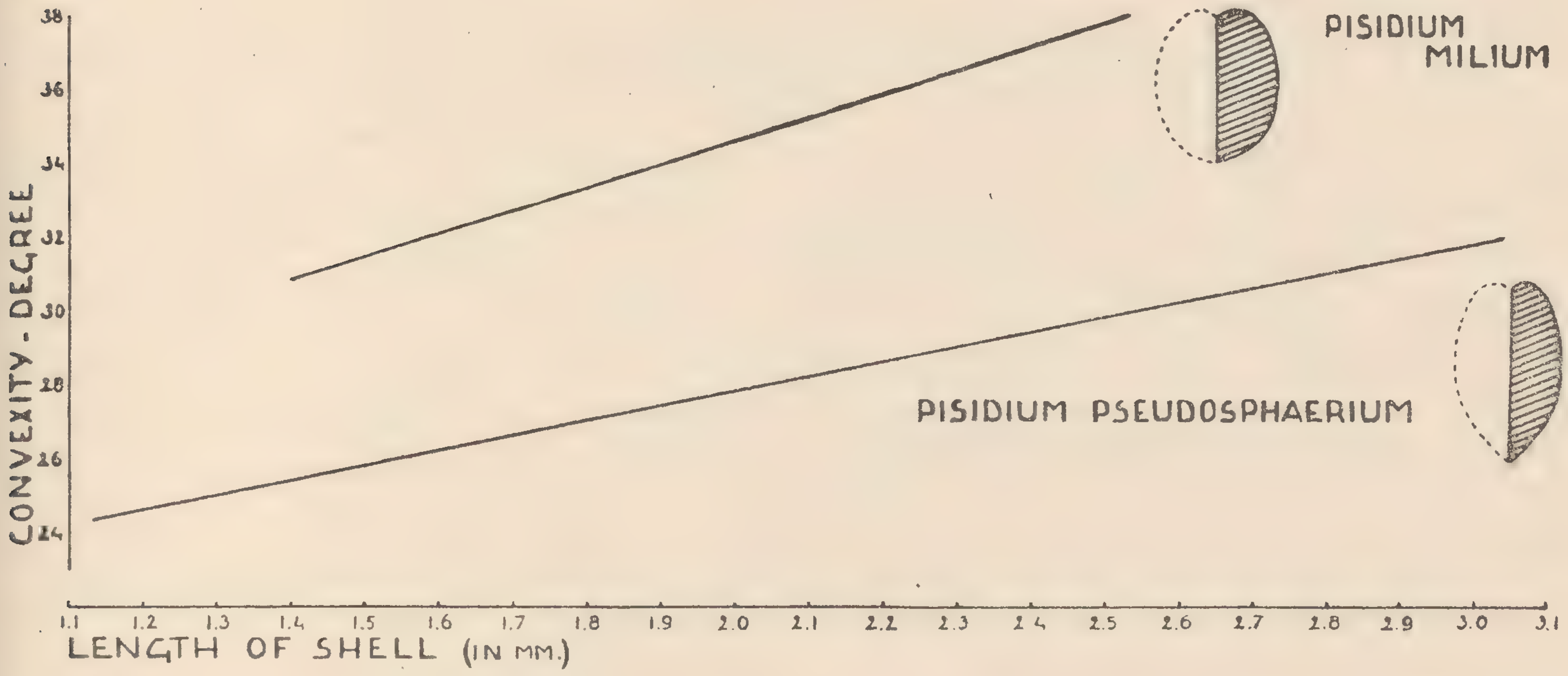

FIG. 2.—Graph illustrating increasing convexity-degree during growth of *Pisidium milium* and *P. pseudosphærium*.

A very noticeable feature is the difference in convexity of the shell. In my paper (1947) on the freshwater Mollusca of the Naardermeer I tried to show this in a statistical way, by calculating the "convexity degree" ($\frac{100 \times \text{width}}{\text{height}}$ of single valve) of an equal number of both species *from the same loci*. The "convexity degree" of the whole material, counting individuals of all ages, proved to vary from 24 to 43; the frequency curve of these values, of which the lower ones belong to *P. pseudosphærium* and the higher to *P. milium*, showed clearly two apices (fig. 1). This measurable morphological hiatus remains constant in the successive ages (fig. 2). Comparable results have been obtained by measuring series from other Netherlands localities and the fossil Pisidia from Möen, an account of which was published by Schlesch (1947).

The dimensions and convexity degrees of the *P. pseudosphærium* collected at Pevensey in 1927 are as follows:—

Length.	*Height.*	*Width.*	*Convexity Degree.*
3·20 mm.	2·46 mm.	1·58 mm.	32
2·97 mm.	2·30 mm.	1·48 mm.	32
2·93 mm.	2·31 mm.	1·32 mm.	29
2·82 mm.	2·26 mm.	1·31 mm.	29
2·80 mm.	2·20 mm.	1·37 mm.	31
2·79 mm.	2·23 mm.	1·42 mm.	32
2·70 mm.	2·07 mm.	1·38 mm.	33
2·69 mm.	2·22 mm.	1·34 mm.	30
2·41 mm.	1·94 mm.	1·14 mm.	30

The convexity degree of these specimens may therefore be regarded as characteristic.

There are ecological as well as morphological differences. *P. milium*, which is one of the commonest species of *Pisidium* in the Netherlands, lives in nearly all kinds of water, such as ditches, canals, streams, ponds, lakes and quiet shallow parts of large rivers. *P. pseudosphærium*, on the other hand, has been collected only in clear, stagnant, often densely vegetated swamps and peaty ditches. In the neighbourhood of Utrecht and Heusden, Netherlands, it has also been collected in old fortress moats and adjacent ditches, as at Pevensey. Owing to its particular ecological preference *P. pseudosphærium* often occurs without any other species of *Pisidium*. In this connection it may be apposite to quote the following extract from a letter of M. Favre (9 December 1945): " Dans les marais des bords du lac du Bourget, tant à son extrémité sud qu'à son extrémité nord, j'ai trouvé *pseudosphærium* seul, sans *milium*. Cela semble être en faveur de votre opinion."

In habitats in which *P. pseudosphærium* is the numerically dominant *Pisidium* it often attains markedly larger dimensions than the associated *P. milium*, a phenomenon which may indicate a specifically different reaction with the environment.

Characteristic elements of the biotopes inhabited by *P. pseudosphærium* are *Planorbis vorticulus* Troschel and *Sphærium corneum* var. *nucleus* Studer, and in some localities in the Netherlands and Germany the rare *Planorbis riparius* Westerlund. Another feature worth mentioning is the even incrustation of micro-organisms which frequently covers the whole shell of *P. pseudosphærium*, whereas this incrustation is absent or has only occasionally been observed on the shells of associated Pisidia. Specific difference often finds expression in different kinds of incrustation; examples of this phenomenon are not infrequent in malacology. It seems to me that in this instance it is not mechanical factors, such as a rough or smooth shell surface, that are responsible for the difference in incrustation, but rather biological causes. The difference in incrustation might here be an indication of specific biological differences.

The soft parts of *P. pseudosphærium* have recently been examined by Professor Odhner, who wrote me (1 September 1947) that he had reached the conviction that *P. pseudosphærium* represents a good species, the morphology of the soft parts being, quite as much as the conchological characters, intermediate between *P. nitidum* and *P. milium.*

Comparing critically the observations on the Geneva material with those mentioned above, I modestly believe that the latter must prevail in deciding the systematic status of *P. pseudosphærium.* In the light of the new facts there is, in my opinion, no more reason to consider *P. pseudosphærium* as a subspecies or variety of *P. milium* than, for example, *P. milium* and *P. nitidum*, or *P. cinereum* and *P. personatum*, as different forms of one species.

Very little is so far known about the geographical distribution of *P. pseudosphærium.* Outside the Naardermeer this species has been recorded from some twenty localities in the Netherlands ; it is also known from Brandenburg and Pomerania in Germany, Geneva in Switzerland, and Lac du Bourget, France. It is found as a Holocene fossil in Denmark. Pevensey is the only locality known so far in the British Isles.

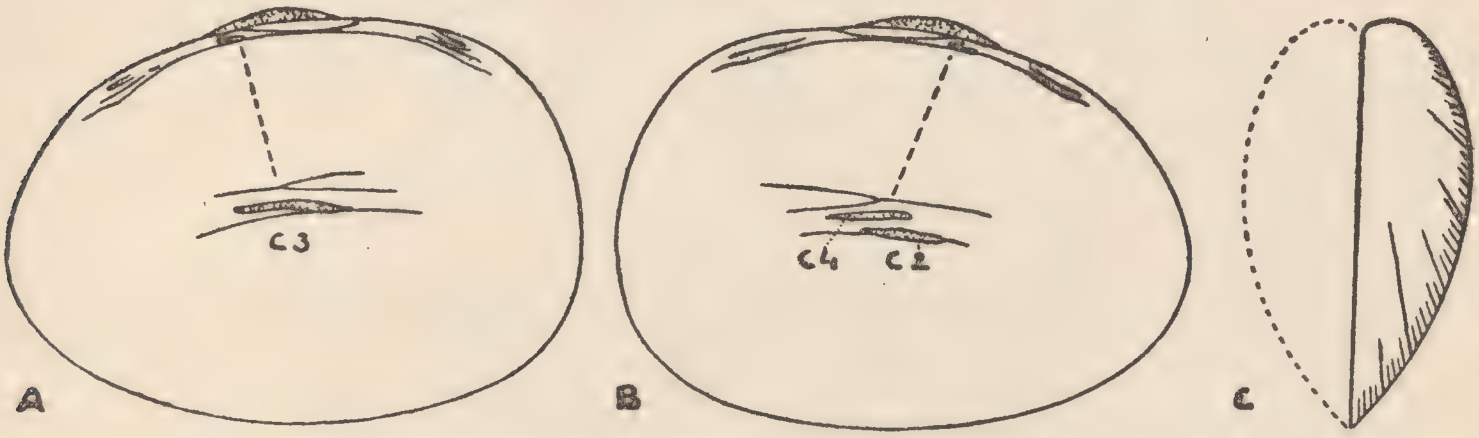

FIG. 3.—*Pisidium pseudosphærium* Favre, Pevensey (A. E. Ellis) : (A) interior of right valve ; (B) interior of left valve ; (C) frontal aspect.

DESCRIPTION OF *PISIDIUM PSEUDOSPHÆRIUM* FAVRE.

Shell compressed, subequilateral, oval or slightly quadrangular, thin and fragile, straw coloured ; dorsal and ventral margins rather equally curved, converging anteriorly ; umbones smooth, median, flattened, scarcely projecting, slightly progyrous ; surface with fine, rather regular, sharp striæ gradually vanishing towards the umbones ; adductor muscle scars reniform, showing through the translucent shell, clearly inserted higher anteriorly than posteriorly ; shell not porous. Dimensions : length, 2·56 mm. ; height, 2·04 mm. ; width, 1·17 mm. ; largest specimen, 3·25 × 2·6 × 1·7 mm. ; generally under 3 mm. long.

Hinge-plate long and narrow, nearly as broad below the umbones as laterally ; ligament-pit long and narrow, occupying almost the whole width of the hinge-plate ; cardinal teeth weak, short, straight, parallel, *c4* slightly posterior, *c2* often somewhat projecting into the interior of the shell. A well marked feature of the hinge is the relative position of the teeth, the distance between the cardinals and the posterior lateral cusps being nearly twice as long as that between the cardinals and anterior laterals.

In outline this species bears some resemblance to some forms of *P. milium* Held, *P. nitidum* Jenyns and juvenile *Sphærium corneum* (L.). From the former it generally differs in its more elongate shape, its less swollen, scarcely raised umbones, its more regular striation, its often silky gloss (as in *P. hibernicum* Westerlund), its narrower hinge-plate with longer ligament-pit, and its distinctly higher insertions of the adductor muscles.

The convexity degree ($\frac{100 \times \text{width}}{\text{height}}$ of single valve) of both young and mature specimens varies from 23 to 34, the average being about 29. In *P. milium* these values are 34 to 44, with an average of about 39.

From thin *P. nitidum* and depauperate forms of *P. cinereum* Alder it may be separated by its more elongate shape, its narrower hinge-plate, being laterally only a little broader than cardinally, and its markedly longer ligament-pit. Moreover in *P. pseudosphærium* there are no umbonal grooves or even indications thereof as in *P. nitidum*, and no microscopic pores in the shell as in *P. cinereum* (magnified × 40).

In outline this species bears some resemblance to juvenile *Sphærium corneum*, but the latter is comparatively higher, its striation coarser, its shell thicker, the configuration of its hinge-plate quite different owing to the stouter plate and teeth, the longer curved *c4* and the relatively shorter ligament-pit.

Often covered with a thin, blackish or greenish, granulate coat of microscopic algæ, while other Pisidia from the same place are nearly clean.

SYNONYMY.

Pisidium milium Held, forme *pseudo-sphærium* Favre (1927, 306).
P. milium Held, mode *pseudo-sphærium* Favre (1927, 305).
P. milium Held, forme *pseudosphærium* Favre (1940, 344).
P. milium Held, var. *pseudosphærium* Favre (1940, 369, 370).
P. milium Held, var. *pseudosphærium* Favre : Jutting and Kuiper (1942, 59, pl. 2, figs. 1–3).
P. milium Held, var. *pseudosphærium* Favre ; Jutting (1943, 163 ; 1947, 79).
P. pseudosphærium Favre : Altena (1945, 139).
P. pseudosphærium Jutting and Kuiper : Schlesch (1947, 138).
P. (*Eupisidium*) *favrei* Kuiper (1947, 35, pl. 5, fig. 61).

REFERENCES.

ALTENA, C. O. VAN REGTEREN, 1945. Holocene Mollusken van Stompwijk (Z.H.). *Corr. Bl. Ned. Mal. Ver.* No. 24.

FAVRE, J., 1927. Les Mollusques post-glaciaires et actuels du bassin de Genève. *Mém. Soc. Phys. et Hist. nat. Genève* **40**, fasc. 3, 171–434, pl. 14–27.

—— 1940. La faune malacologique post-glaciaire et actuelle du Lac du Bourget. *Annales de l'École Nationale des Eaux et Forêts* **7**, fasc. 2, 295–475, pl. 1–13.

JUTTING, W. S. S. VAN BENTHEM, 1943. *Fauna van Nederland* afl. **12**.

—— 1947. Lijst van Gemeenten als Vindplaatsen van Nederlandsche Mollusken. *Basteria* **11**, 54–86.

—— and KUIPER, J. G. J., 1942. De Lamellibranchia van het Naardermeer. *Basteria* **7**, 53–71.

KUIPER, J. G. J., 1947. Bijdrage tot de kennis der zoetwaterweekdieren van het natuurmonument Naardermeer. *Basteria* **11**, 2–53.

SCHLESCH, H., 1947. The Pisidia of the Tövelde Klint. *Proc. Malac. Soc.* **27**, 137–140.

A NOTE ON THE DISTRIBUTION OF *ANODONTA CYGNEA* (L.), HAVING REGARD TO DIFFERENCES IN SEX AND GILL-STRUCTURE.

By H. H. Bloomer.

During my investigation into the sex and gill-structure of *Anodonta cygnea* taken from Bracebridge Pool, Sutton Park, Warwickshire (Bloomer, 1930, 1934), it was found that not only were there males and females but that hermaphrodites were present too; that, besides a number of individuals having either marsupial or non-marsupial outer gills (gill-plates) according to the sex, there were some individuals with the outer gills of a modified structure, in that the interlamellar septa did not possess completely the characters usually associated with typical male or female outer gills. Furthermore, an examination of the gonads of the individuals with modified outer gills disclosed that among them were some males and hermaphrodites.

On the other hand, from an examination of a large number of individuals from Highams Pool, Epping Forest, Essex (Bloomer, 1935, 308–316), and a much larger quantity from the River Frome area, Dorset (Bloomer, 1939, 288–297; 1943, 194–7), it appeared that the Highams Pool individuals were either females or hermaphrodites and those from the River Frome area were probably all hermaphrodites, and that in both places the outer gills of all the individuals were of a marsupial nature.[1]

In the meantime I had examined samples from (Bloomer, 1939, 286–8):—

(1) Beam Brook, Newdigate, Surrey: smears of gonads of all the individuals except one proved them to be hermaphrodites; the outer gills of all were probably of a marsupial character.

(2) The lake, Newdigate Place, Surrey: one male, one female and one hermaphrodite; all had marsupial outer gills.

(3) The lake, Musicians' Home, near Holmwood, Surrey: all were hermaphrodites with marsupial outer gills.

(4) The moat, Court House, Eardisland, Herefordshire: smears of gonads showed most of the individuals to be hermaphrodites—the sex of some could not be wholly determined; the outer gills of all were of a marsupial nature.

Moreover, I had sections prepared of some preserved specimens and one individual from each of the following localities revealed (Bloomer, 1939, 295, 296):—

(*a*) Hill Hook, South Staffordshire: sections of gonads had several patches of maleness amid reticulated tissue; outer gills were non-marsupial.

(*b*) Hindley Pool, Worcestershire: the individual possessed non-marsupial outer gills; no section of gonads was made.

(*c*) Kennet and Avon Canal, Bathampton, Somerset: sections of gonads had patches of maleness surrounded by reticulated tissue; the outer gills though exhibiting some features of a modified nature were probably non-marsupial in function.

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[1] For a fuller account reference should be made to the author's previous papers.

(*d*) Chichester and Arundel Canal, Hunston, Sussex: sections of gonads disclosed only maleness; the outer gills were of a non-marsupial character.

In (*a*), (*b*) and (*d*) there were very few specimens and only one in (*c*).

Besides the above and by the help of Flatters and Garnett, Ltd., of Manchester, I had the opportunity of examining a sample of twelve individuals gathered in November 1948 from the northern part of Hertfordshire.

The mussel is a ventricose form of the variety *zellensis* Gmelin. The shells are moderately large and measure (antero-posterior measurement) from 11·9 to 13·4, the average being 12·7 cm. in length.

All the animals had the outer gills well filled with glochidia and the smears of the gonads showed male and female products very similar to those mentioned later from the marl-pit near Raby.

The sample suggests that all mussels in this locality are probably hermaphrodites and possess marsupial outer gills.

While considering the results of previous investigations it seemed desirable to ascertain the conditions prevailing further north, particularly in Cheshire, Lancashire and Yorkshire, therefore I sought the help of naturalists living in those counties, but owing to various causes the number of specimens received so far has been very few, with one exception, and that is a very nice sample gathered in October 1948 from a water-filled marl-pit and sent to me by Mrs. N. F. McMillan and Mr. J. F. Egan. Although from a small pool the result of the examination of the sample is so informative as to merit a detailed description.

They say that the marl-pit is situated near Raby in Cheshire, is approximately 93 sq. yd. in area and 8 ft. in the deepest parts, 3 ft. to 5 ft. where the mussels were gathered. There is a good growth of water plants, *Elodea* and *Potamogeton*, and of marginal ones, *Callitriche* and *Equisetum*. The fish present are perch, roach, tench, carp, bream, pike, eel and stickleback.

It is believed the mussels were introduced about 1912. They are now relatively plentiful, have a healthy appearance and grow to a moderately large size. In shape the shell is an elongated form of typical *A. cygnea*, and the mussels are found in association with *A. anatina* var. *piscinalis* Nilsson.

The sample consists of seventeen individuals, fifteen of which vary in length from 9·1 to 15·0 cm. and average 12·0 cm. All of these fifteen individuals with one exception had glochidia in the outer gills, the glochidial shell being well formed. The outer gills of the one not carrying glochidia are of a marsupial character.

Smears taken from the antero-dorsal part of the gonads disclose all the individuals to be hermaphrodites, those of some of the individuals have a large quantity of sperm-morulæ in different stages of development with a moderate number of spermatozoa, in one a large number; some with sperm-morulæ or spermatozoa not so plentiful; and some in which both are relatively scarce ; these differences in quantities occur irrespective of size or age of the individual. Relict ova are present in the smears of all the individuals, usually of medium to small size and in moderate quantities ; moreover, there are to be seen formerly mature ova now more or less denuded of their contents. The smear of the individual not carrying glochidia in the outer gills contains a large number of sperm-morulæ in different growth-stages and a fairly dense quantity of spermatozoa, but there is a comparative scarcity of ova. It would therefore appear that the failure to spawn at the normal time was due to the unripened condition of the ova in the gonads. The smears of the two small individuals (5·4 and 4·5 cm.) contain what seem to be disintegrating spermatozoa but there is no other evidence of sex.

A not uncommon feature of one specimen was that when examined it was in the act of extruding the glochidia. This may have been due to some abnormal circumstance as the state of the outer gills showed that the discharge had not proceeded very far (Bloomer, 1935, 318). *A. cygnea* belongs to those mussels that have been termed " long period of gravidity " ones and normally discharge their glochidia from March to May, but premature extrusion of the glochidia has been observed before (Bloomer, 1935, 318).

So far as investigated there is in the marl-pit near Raby a sex-phase of *A. cygnea* in which all the individuals are hermaphrodites and all possess outer gills of a marsupial nature ; these characters are similar to those prevailing in the River Frome area, Dorset, Holmwood, Surrey, and the northern part of Hertfordshire, and possibly in their sex-phases those in Highams Pool, Epping Forest, Beam Brook, Newdigate, and the Court House, Eardisland, Herefordshire, may on re-investigation prove to be not very dissimilar to them, and furthermore are remindful of the observations of A. E. Boycott at Elstree reservoir, Hertfordshire, and Charles Oldham at the canal reservoir, Tring, Hertfordshire (Bloomer, 1935, 319).

It is better in collecting to make the sample as representative as possible by gathering the mussels from different parts of the pool or section of the stream or canal, especially in the summer months,[1] otherwise the sample may not include some sex-phase in that locality. Such was my experience of the fifteen individuals taken in 1932 from Bracebridge Pool when there was not one male in the sample (Bloomer, 1934, 24).

In giving the results of the examination of the preserved specimens referred to earlier there is the possibility that the representation is incomplete owing to the fewness of the individuals and they may not be typical of what would have been disclosed if a larger number had been available. Nevertheless they and the previously mentioned investigated samples provide an indication, though a slender one, of the area-extension of the different sex-phases, and thereby serve the aim of connecting the northern with the southern portion of England on the western side of the country.

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[1] " There is reason for believing that towards the spawning season and the advance of warmer and sunnier weather the mussels migrate from deeper to shallower water for the maturing of the gonads and for spawning " (Bloomer, 1946, 62).

I wish to thank Mrs. McMillan and Mr. Egan for their kind assistance, also those who have promised to try and obtain samples from the area under investigation.

References.

Bloomer, H. H., 1930. A note on the sex of *Anodonta cygnea*. *Proc. Malac. Soc.* **19**, 10–14.

—— 1934. On the sex, and sex-modification of the gill, of *Anodonta cygnea*. *Proc. Malac. Soc.* **21**, 21–8, pl. 3.

—— 1935. A further note on the sex of *Anodonta cygnea* L. *Proc. Malac. Soc.* **21**, 304–321.

—— 1939. A note on the sex of *Pseudanodonta* Bourguignat and *Anodonta* Lamarck. *Proc. Malac. Soc.* **23**, 285–297.

—— 1943. A further note on experiments on self-fertilization in *Anodonta cygnea* (L.). *Proc. Malac. Soc.* **25**, 192–200.

—— 1946. The seasonal production of spermatozoa and other notes on the biology of *Anodonta cygnea* (L.). *Proc. Malac. Soc.* **27**, 62–8.

A SHELL DEPOSIT IN THE PORTSTEWART SAND-DUNES.

By Nora Fisher McMillan.

The sand dunes at Portstewart, Co. Londonderry, extend westward towards the present mouth of the River Bann for a distance of about 1⅜ miles. They can be divided into two parts, the older dunes lying to the east and the younger forming the western portion and ending in Ballyaghran Point. The older dunes contain kitchen middens with artefacts, etc., but none has yet been found in the younger part of the range. About halfway along the line of dunes a valley runs almost across the range, separating the older from the younger part. In this valley where it approaches the inner margin of the dunes my old friend R. J. Welch and I collected many shells in 1934 and 1935. Altogether 42 species were represented, all still to be found in the district. Some had almost certainly been derived from a kitchen midden (*Buccinum undatum*, *Lutraria lutraria*, *Cyprina islandica*, *Patella vulgata*, *P. athletica*); the first three species were represented by abundant broken shells, while the limpets were also abundant. Mr. Welch suggested that possibly the hinge fragments of *Lutraria* had been used as scrapers, as they were in N.W. Donegal. A flint core was found also and the bone of a small cow.

Shells of *Nucella lapillus* were abundant, but all intact, not broken as one would have expected. On the other hand, shells of *Ocenebra erinacea*, which were almost equally abundant, were in every case broken at the second whorl. One is tempted to suggest a "purple" industry based here on *Ocenebra* instead of the more usual *Nucella*.

The deposit appears to have been a kitchen midden on the margin of an old beach in the dunes, uncovered by wind, and the shells obtained are a mixture of those from the midden and those from the beach itself.

CHARONIA LAMPAS (L.) IN THE LOWER LITTORAL ZONE.

By B. S. Kisch.

(*Read before the Society, 18 December 1948.*)

This magnificent animal, the largest European gastropod, is included in the British list on the strength of three specimens trawled at different times between 1825 and 1832 off the coast of Guernsey (Jeffreys, *British Conchology* **4**, 302). I am informed that no further examples have been recorded from the Channel Islands. It is found off the Atlantic and Mediterranean coasts of France and is not uncommon on the Basque coast, where it is brought up in trawls and sometimes in lobster and crab pots. Its habitat is in deep water; it is hardly ever picked up on the beach.

A few months ago, however, I found a number of these great Tritons among the rocks exposed at low spring tide at Socoa, a little village at the western tip of the Bay of Saint-Jean-de-Luz, Basse-Pyrénées. They were all alive and ranged in size from 10 to over 23 cm. Several were seen on each of the four or five subsequent occasions that the same ground was revisited at low spring tide. One was also found alive among the rocks of Sainte Barbe on the opposite side of the bay. The locality in which they occur would seem to exclude the possibility of their having been dumped by fishermen; their number also is against this. When on rocks their large size makes it difficult for them to conceal themselves effectively, but when on a sandy bottom they appear to bury themselves in the sand. It is too early to say whether they are to be found in this situation throughout the year; they were first observed in June and were still present in October. It was noticed that some of them were feeding on the sea-cucumber, *Holothuria forskali* Delle Chiaje.

Monsieur Paul Arné, Director of the Musée de la Mer at Biarritz since 1932, says that this is the first time he has heard of *Charonia lampas* being found living between tide marks, even at the lowest springs. Hidalgo gives its distribution as 20 to 40 metres and its size as 12 to 25 cm. There is a veritable monster living in the aquarium at the Musée de la Mer; it was taken in a crab pot and measures 26 cm. The largest found at Socoa measured 23·5 × 12·05 cm. and weighed alive 1,100 grammes; the shell alone weighed 430 grammes. It was a thrill to find a creature that size in a rock pool.

The distribution of Crepidula fornicata (L.).—In 1945 Bloomer (*J. Conchol.* **22**, 147) recorded the extension of this species in Dorset. I visited Portland on 17 August 1948 and took the opportunity of exploring the shore on the east side of the railway line between Portland and Weymouth, where I found a great many shells of *Crepidula fornicata* all along the tide line. From their fresh condition they were presumably thrown up alive.

T. Edward Belcher.

A NEW NAME FOR *LEUCONIA* GRAY.

By R. Winckworth.

(*Read before the Society, 18 December 1948.*)

The marine pulmonate described as *Voluta bidentata* by Montagu in 1808 has been generally referred to the genus *Leuconia* Gray, 1847, a name preoccupied by *Leuconia* Grant, 1833, in use for a genus of sponges. The alternative name *Leucopepla* proposed by Peile in 1926 is also unfortunately preoccupied (Kirkaldy, 1907). The genus is discussed by Watson (1943, 17–20). From his discussion it seems clear that no valid name is available for this genus, though he tentatively suggests that *Stolidomopsis* Sandberger, 1874, of which the type is *S. deshayesi* (Tournoüer), 1870, may be the name to use. As the name is required for at least two faunal lists, the problem must be looked into. The type species of *Stolidomopsis* is figured for the first time and again described by Tournouër (1871, 80, pl. 3). It is a species of the Middle Miocene (Helvetian) and it may be noted that in this review *Leuconia* is distinguished as a separate genus. I have been unable to see specimens of *S. deshayesi*, but the figures show a shell of markedly different form from that of *Leuconia*. As a name is required to replace *Leuconia*, I here propose the new name **LEUCOPHYTIA** with type *Leucophytia bidentata* (= *Voluta bidentata* Montagu). The generic characters have been given by Thiele (1931, 465) under the name *Ovatella*, which Watson has shown to be wrongly used here. *Leucophytia* differs from *Stolidomopsis* in general facies, in that it has a somewhat ventricose, produced, oval shell wholly convex in outline, while *Stolidomopsis* has a narrow, elongate shell compressed below the suture to give a slight concavity. Both have two columellar folds: in *Stolidomopsis* the hollow between them cuts deeply into the columella, while the edge of the columellar lip is excavated near the end of the upper fold; in *Leucophytia* the edge of the columellar lip forms a regular convex curve.

References.

Thiele, J., 1931. *Handbuch der systematischen Weichtierkunde* **2**.

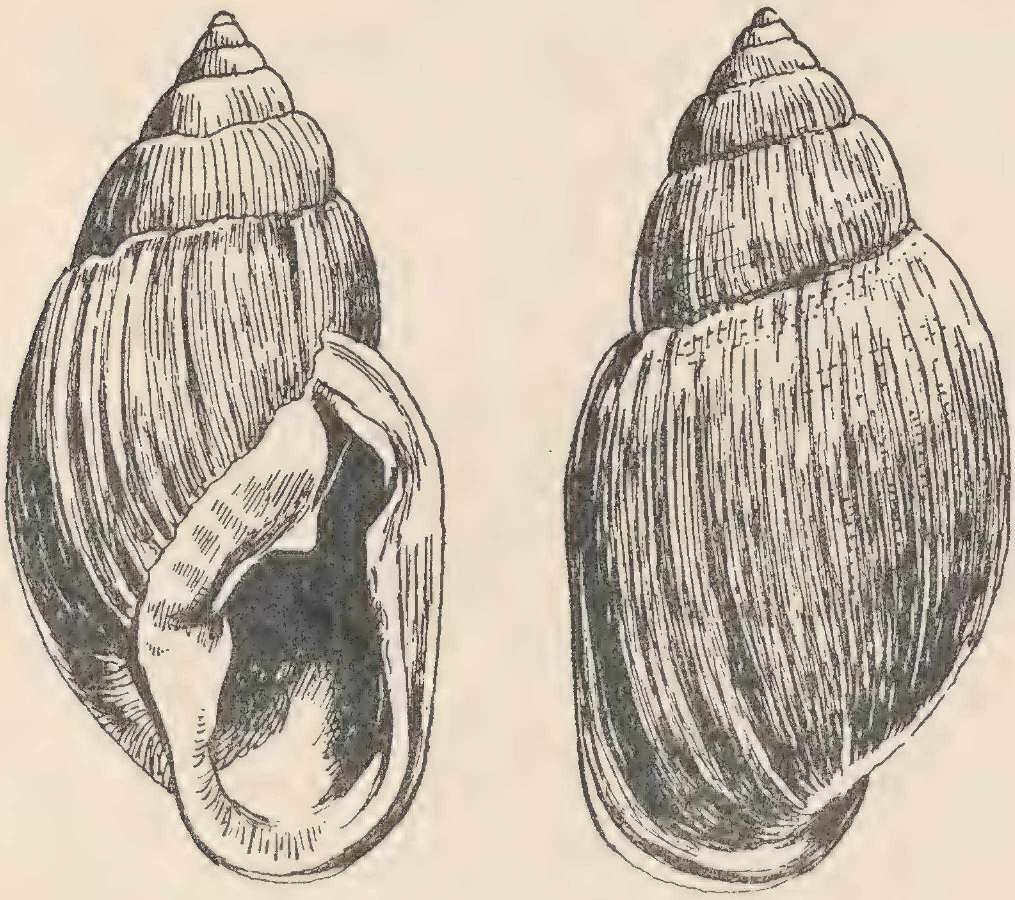
Tournouër, R., 1871. Auriculidées fossiles des faluns. *J. Conchyl.* **20**, 77–116, pl. 3, 4.

Watson, H., 1943. Notes on a list of the British non-marine Mollusca. *J. Conchol.* **22**, 13–22, etc.

PLACOSTYLUS FALCICULA (GASSIES).

By T. PAIN.

THIS species, originally described as *Bulimus falcicula* by Gassies (1871, 190) from a specimen collected in Bai du Sud, New Caledonia, by Lambert, has never been figured so far as I have been able to ascertain. The discovery therefore of further specimens obtained at the type locality in 1945 has prompted the publication of the accompanying figure. This specimen was selected on account of its close resemblance both in appearance and dimensions to Gassies' type. These shells occurred in a layer of coarse sand exposed in a temporary excavation and covered by a thick deposit of humus, conditions apparently similar to those in which *P. senilis* (Gassies) is found in the Ile des Pins, New Caledonia.



Gassies' description of *P. falcicula* is as follows : Destitute of cuticle and colour, long-oval, ovate, noticeably perforate, strongly striate longitudinally, cut by transverse striæ and imbricated, the suture margined and puckered. Whorls seven, slightly convex, the last two-thirds the total height, aperture ovate, very angular above and rounded at the base, ends of the peristome connected by a thick callus bearing a median, conical tooth. Columella subvertical, without external twist. Outer lip strongly notched above, sickle-shaped, the lower termination of the notch forming an almost acute angle. Peristome very convex, light yellow with nacreous reflections ; interior retaining some trace of orange colour.

MEASUREMENTS (In Millimetres).

	Gassies' Type (copied from Gassies).	*Figured Shell from Bai du Sud.*
Total height . . .	80	75
Maximum width .	40	40
Oblique height of mouth .	44	42
Maximum width of mouth . . .	15	15

As noted by Pilsbry (1900, 46) the curious sickle-shaped upper termination of the outer lip is a particularly striking characteristic of this species. The shell here figured shows traces of orange colour in the interior as noted by Gassies, whose description would do equally well for this shell as for the type. Two other specimens taken at the same time show similar traces of colour. The figured shell is the largest found.

I am indebted to Mr. G. L. Wilkins for the excellent illustration which accompanies this note.

REFERENCES.

GASSIES, J. B., 1871. Faune conchyliologique terrestre et fluvio-lacustre de la Nouvelle Calédonie. *Act. Soc. Linn. Bordeaux* **28**, 1–212 (date on title page 1871, on cover 1872; reissued in book form, dated 1871, Paris).

PILSBRY, H. A., 1900. Tryon's *Manual of Conchology* (2) **13**.

Note on Mysia undata (Pennant).—In a collection of lamellibranchs taken in muddy sand in Loch Sween, Argyll, a small bivalve appeared and was provisionally listed as *Lucinopsis undata* (= *Mysia undata*). The late Mr. R. Elmhirst and Dr. A. C. Stephen kindly confirmed my determination and the shell appeared to correspond with the description given by Jeffreys (*British Conchology* **2**, 1863, 363, 364), with an important exception. Jeffreys states that there are three cardinal teeth in the right valve and only two in the left; my specimen very clearly showed three cardinal teeth in the *left* valve and two in the *right*, thus agreeing with the description in Forbes and Hanley (*British Mollusca* **1**, 1853, 433). I was also privileged to examine the specimens of *Mysia undata* in the British Museum (Natural History) and found that all these shells corresponded to the one in my possession. It would therefore appear that Jeffreys has reversed the two valves in his description of the shell; his figure (**2**, pl. 7, fig. 1), however, seems to be correct and in fact does not agree with his text. In one minor point as regards the hinge-teeth my specimen does not agree with Forbes and Hanley's description, namely the posterior cardinal in the right valve is described as bifid, whereas my specimen appeared to have a simple tooth. I considered that the difference might have been due to my specimen being young, measuring only 13 mm. in length. Reference to the British Museum collection, however, showed that the right posterior cardinal was by no means always bifid. Thus of ten examples, mostly full grown, taken at random, two showed a clearly bifid tooth, two showed the tooth less markedly split, while in the remaining six specimens the tooth was practically simple. The large middle cardinal in the left valve is always very obviously double, as described by Forbes and Hanley.

J. E. G. RAYMONT, *Zoology Department, University College, Southampton.*

LAND MOLLUSCA ON THE ISLE OF MULL.

By L. B. Langmead.

During the last week of August and first week of September 1948 I was staying at Tobermory, Isle of Mull, Inner Hebrides. During this fortnight the weather was of a western type, damp and mild. Most days started with rain or mist, clearing to warm sunshine by the afternoon with a steamy atmosphere, perfect conditions for the conchologist.

Mull, like Morven on the opposite side of the Sound, much of Skye, and several of these western isles, is overlain by vast horizontal sheets of basaltic lava deposited in the Tertiary period. Previous to this there is no doubt that most of the west coast of Scotland was completely covered by Cretaceous and Jurassic strata, nearly all of which have been stripped off by erosion. Some traces, however, still remain ; for instance, on Mull many flints are to be found in the subsoil which must have been derived from the chalk. There are also some pebbles of chalky sandstones and greensands to be found, especially in the neighbourhood of Tobermory.

The areas in which I collected were three, all in the northern part of the Island. The first and by far the most prolific area was around Tobermory itself ; the second was at Calgary on the west coast and the third in the vicinity of Loch Ba.

Tobermory, which is the main town and port of the Island, is situated on the northern shore of a fine natural harbour, the western and southern shores of which are covered down to the water's edge with dense woodland, beech predominating. The ground here rises steeply for about 100 to 150 feet before it flattens out and becomes more open. The floor of the woodland is rocky, with moss-grown boulders in many places and burns hung with moss and fern running down to the sea. These woods, dense on the steeper slopes, thin out as the land becomes more level and there are two lines of old stone wall bordering the western edge. It was in this area and in the open meadow-land beyond that most of the collecting was done. Although other areas in the vicinity were examined and yielded several species, few were found which were not taken in this woodland bordering the harbour.

In the woodland itself, on the steeper slopes, the following species were taken : *Carychium minimum* Müller (? *tridentatum* Risso), *Lauria anglica* (Wood), *L. cylindracea* (da Costa), *Acanthinula aculeata* (Müller), *A. lamellata* (Jeffreys), *Cochlicopa lubrica* (Müller), *Discus rotundatus* (Müller), *Clausilia bidentata* (Ström), *Limax maximus* L., *L. marginatus* Müller, *Hygromia hispida* (L.), *Euconulus fulvus* (Müller), *Retinella pura* (Alder), *R. nitidula* (Draparnaud), *Oxychilus cellarius* (Müller), *O. helveticus* (Blum).

On one of the walls bounding the western edge of the woodland *Balea perversa* (L.) was found. This wall, about 4 feet high, had a small ditch on its western side in which I found an old cardboard egg-box. Adhering to the under surface of this box were four specimens of *Vertigo alpestris* Alder. Following the wall to the southward I came to some large boulders lying in the open and standing some 6 to 8 feet high, surrounded by a tangle of rose and bramble. There was enough soil and debris on these boulders to give root-hold to a few meagre rosette Compositæ. Here I found several more *V. alpestris*. I examined the wall almost throughout its entire length but found no other specimens upon it. It was particularly interesting to find this species in a " natural " habitat, although there was a wall so near, in view of Boycott's remark that in England it is hardly known apart from walls. The wall was low and very open ; being narrow and built of rounded stones it gave very little shelter, which may account for the failure of *V. alpestris* to make use of it. This species has not previously been recorded from Scotland. In this region there was also a large colony of *Ashfordia granulata* (Alder) and a few *Arianta arbustorum* (L.) were observed. In addition the following species were found around Tobermory : *Vitrina pellucida* (Müller), *Agriolimax reticulatus* (Müller), *Arion ater* (L.), *A. hortensis* Férussac.

Turning to Calgary in the west we find a very different type of country. Here is another large natural harbour, but instead of wooded slopes there is a wide sandy beach with a line of dunes and links with short turf beyond. The dunes and links are covered with *Helicella caperata* (Montagu), *H. itala* (L.) and *Cochlicella acuta* (Müller). Near by on some grazing land bounded by a lane heading to a small farmhouse were found *Vallonia pulchella* (Müller) and *Vertigo pygmæa* (Draparnaud). *Helix hortensis* Müller was found on herbage in the lane and on the sand-dunes, though not commonly. There was a kitchen garden of about half an acre alongside the farmhouse and some cultivated land to the south of the bay. This land yielded *Helix aspersa* Müller, *Hygromia striolata* (Pfeiffer) and *Oxychilus alliarius* (Miller). This last species came as something of a surprise in this situation, although there was a small wood in the immediate vicinity from which it may easily have strayed. Several of the species found in the Tobermory area also occurred here.

The third area investigated, in the region of Loch Ba, provided five additional species : *Arion intermedius* Normand, *Agriolimax lævis* (Müller), *Columella edentula* (Draparnaud), and the aquatics *Lymnæa peregra* (Müller) and *Ancylus fluviatilis* Müller. I have no doubt that other freshwater species are to be found, as there are multitudinous burns throughout the Island and several large sheets of water, such as Loch Frisa, over four miles long and half a mile wide, Loch Ba and the Mishnish lochs. I made no attempt to search for aquatic Mollusca during my stay ; the two mentioned were found in a small stream beside which I found *A. lævis*.

Altogether forty species were seen on the Isle of Mull during my brief visit, ten of which have not been previously recorded for Mid Ebudes. The total number of species of non-marine Mollusca recorded for vice-county 103 is only sixty, so it is evident that the area would repay more intensive investigation. My own collecting was dilettante and restricted to land species, as I was only on a family holiday and did not go to Mull with the express purpose of studying Mollusca.

COLONIZATION OF LAND SNAILS.

By L. W. STRATTON.

UNDER the above title Boycott (1936) recorded the establishment in his garden at Radlett, Hertfordshire, of colonies of *Helix pomatia* L. and *Laciniaria biplicata* (Montagu). The former, introduced in 1920 and 1923 and added to in 1926, apparently flourished; the latter, brought from Chiswick in 1925, seem to have disappeared until 1930, from which year to 1935, when Boycott left Radlett, there were always a few about. He also wrote (1919) of *Hygromia striolata* (Pfeiffer), " Two attempts to colonize it among *Arabis* in my garden at Radlett from a Gloucestershire garden have apparently completely failed. A single specimen was found in 1920, the original planting having been in 1915."

On 29 March 1946 I discovered *Laciniaria biplicata* in Moses Dell, an ancient chalk-pit half a mile south of Boycott's old garden. On this occasion I found first a broken dead shell and then a live one under a large log. For the rest of 1946 I could always find one or two on the log and others under pieces of dead bark I laid down as traps. Although the log and some of the bark disappeared in the severe weather of early 1947, live snails were still to be found up to the end of 1948, never in large numbers and confined to one small area of the Dell. I have found them on small pieces of dead stick but never on the ground.

Boycott visited Moses Dell many times and left careful records of his finds there, but makes no mention of this snail. Had he planted it there I feel sure he would have said so. It would seem, therefore, that the founders of this colony must have wandered from his garden. This could have been no mean feat, involving the crossing of a road and two open fields, besides several gardens, or by hedgerows, a journey of at least a mile, and must have occupied several generations of snails.

On 26 April 1946 I visited Boycott's garden, then much overgrown. *Helix pomatia* was still flourishing in spite of efforts to exterminate it. I found five fine full-grown specimens and many smaller ones. Although I searched carefully I could find no sign of *Laciniaria biplicata*, but *Hygromia striolata* was abundant, particularly in an old strawberry bed. In 1919 Boycott considered this a rare snail in the parish. Although it has now increased both in numbers and in distribution in many parts of Aldenham, its abundance in the garden seems to point to the success of his experiment.

An interesting find in the same strawberry bed was a shell, in perfect condition, of *Planorbis planorbis* (L.). This must have been thrown out from one of Boycott's experimental jars at least eleven years before.

REFERENCES.

BOYCOTT, A. E., 1919. Survey of the land Mollusca of Aldenham. *Trans. Herts. Nat. Hist. Soc.* **17**, 153.

—— 1936. Colonization of land snails. *J. Conchol.* **20**, 224.

SOME EIGHTEENTH CENTURY CONCHOLOGISTS.

By Warren R. Dawson, F.R.S.E., F.S.A.

(*Read before the Society, 18 December 1948.*)

Amongst the announcements of deaths in the *Gentleman's Magazine* (1785, **2**, 573), the following quaint paragraph appears :—

> 2 July 1785.—Mr. Jacob Neilson, aged near 80, at Vauxhall Gardens, as he was preparing his kettle drum, on which he had been for 50 years esteemed a first-rate performer. He was a curious comparative observer of nature in conchology and the fossil world, of which he has left a very good collection. He retained his memory and cheerfulness to the last, insomuch that in almost any conversation he would introduce a quotation of several pages, and repeat it verbatim. He was of Scotch extraction ; but his father and mother and himself having been for near a century inhabitants of London, it is not known that he has left any relation.

Our information respecting this singular personage might have been limited to the few statements in the foregoing paragraph, but fortunately Emanuel Mendes da Costa, who knew him personally, sent to John Nichols a fuller account which was published in the latter's *Literary Anecdotes of the Eighteenth Century* (**9**, 812). This account, which is of sufficient interest to quote in full, mentions several other persons whose names are connected with conchology. Before referring to these, however, it will be convenient first to insert da Costa's communication. It will be observed that the obituary notice gives the christian name as Jacob, whereas da Costa calls him John ; the latter, coming from a personal friend, is more likely to be correct.

> I was acquainted with Mr. John Neilson before the beginning of 1751, and got to his acquaintance by way of Mr. Arthur Pond, the Painter, and famous collector of shells. Mr. Neilson then lived with Mr. Pond at his house, beginning of Queen-street, Lincoln's-inn-fields ; and at that very time was of the band of the Vauxhall musick : he lived with and at Mr. Pond's till he (Pond) died, in 1758. He was the instigator and manager of all Pond's collections, for Pond was only a virtuoso, but Neilson a scientific man ; and indeed all Pond's science, and collections of shells, fossils, etc., were entirely owing to Neilson's assiduity and knowledge. However, at Pond's death, it was found that, after such a strict intimacy and friendship with Neilson, he had not even mentioned him in his will, nor desired his aid and care in disposing of his curious collections ; but made demands on him, though, indeed, the elegance of them was all due to Neilson's skill and knowledge. This was supposed to be caused by a jealousy Pond had of Neilson, on account of Mrs. Knapton, who was Pond's housekeeper ; and perhaps too well founded, for she afterwards lived with Neilson. However, this was a cruel behaviour to Neilson. To return : All Pond's collections were sold at Langford's soon after his death, and, as reported, yielded about 1,000 *l.* Numbers of curious fossils, as Sheppey fish, vertebræ, and other parts, lobsters, crabs, etc., of clay-stone, most elegantly and scientifically cleaned of the clay-stone, etc., by Neilson, were sold in it, and fetched good high prices. I bought a lobster and some other fossils in claystone for Dr. Edward Wright, who bequeathed them, with his MSS. Library, etc., for the Edinburgh College (museum), where, I presume they are now. Mr. Neilson died July 4, 1785, at Vauxhall. He dropped down in an apoplectic fit, and expired immediately. He was a performer on the kettle-drum at that place, and he belonged to the band at Vauxhall fifty years. He was said to be upwards of 80. I knew him well ; he was a small, lively, and jocose man ; healthy, wore his age very well ;

I did not think him so old as was said, but upon recollection he must have been about that age. He was very scientific and curious, but especially fond of chemical works, and would repeat the poetical parts of many of them by heart. Ashmole's "Theatrum Chemicum" was his delight. He was also curious in all Natural History, and he cleansed his shells, etc., with great neatness: but his most surprising works were cleaning and freeing all extraneous fossils from their loads, or masses of clay-stone, lime-stone, or other stoney matters, in which they were embedded, in a most surprising and excellent natural and scientific manner, by mere assiduity and patience, without using labour or any artifice; insomuch that any fossils cleaned by him are elegant and natural, beyond expression. He had been taken in former wars with Spain prisoner; and was kept prisoner of war at Vera Cruz, Havanna, etc., before I knew him. He was a Highlander born, but where and when is unknown; for his relations, not any one yet (November 1785), have claimed kindred, so his effects remain unclaimed. He had a good collection of shells and fossils, many of which, especially the latter, are cleaned in perfection, as above said by him, and are very elegant and valuable. Mr. Boydell administered to his effects in 1786; and his Goods, Books, and Collections of Natural History, were sold by public auction, by Hutchins, in King Street, Covent Garden (catalogued by George Humphrey), Aug. 16, 1786, and the two following days, and yielded well; Mr. Hunter, by Mr. Bell, purchasing many capital lots, and Mr. Isaac Swainson many of the Sheppey crabs.—E. M. DA COSTA.

With regard to the various persons mentioned in the foregoing note, I will deal first with the writer of it. Emanuel Mendes da Costa, a member of a well-known Jewish family settled in Portugal, was the son of Moses da Costa, F.R.S., a relation of whom (perhaps his father) is said to have been a physician in the suite of Queen Katharine when she came to England from Portugal to be the wife of Charles II. Emanuel, who was an able man, was himself elected F.R.S. in 1747, when he received the powerful backing of Martin ffolkes, the president, the Duke of Montagu, Peter Collinson and others. He was, like most of the scientists of his time, a polymath; his interests covered a wide field including archæology, geology, mineralogy and particularly conchology and palæontology. He corresponded with all the leading literary and scientific men of his age, including Sir Hans Sloane and William Stukeley. A considerable part of his correspondence has been published by John Nichols in his *Lit. Anecdotes* and *Lit. Illustrations*, especially in volume 4 of the latter work. Early in 1763 the position of Clerk to the Royal Society became vacant and da Costa, again with very influential support, was appointed to the post. On becoming a salaried official of the society, da Costa had to resign his fellowship. The duties of the Clerk in those days comprised functions that are now distributed between the Assistant Secretary, the Librarian and others, and in addition the society then had a museum, the care of which was in da Costa's hands. The rest of his story is a melancholy one: after several years it was found that he had largely neglected his duties and when in December 1767 it was found that he had also embezzled a considerable sum of the society's funds he was dismissed from his office. His library and collections were seized and sold and he was sentenced to five years' imprisonment. After his release he eked out a precarious existence and died in poverty in 1791. He left an only child, a daughter.

After his downfall da Costa continued to publish some important works which entitle him to recognition in the annals of conchology. The chief of these were *Elements of Conchology, or an Introduction to the Knowledge of Shells* (1776) and *Historia Naturalis Testaceorum Britanniae* (1780). In earlier years he had published his *Natural History of Fossils* (1757) and other works.[1]

The next name to mention is that of Neilson's associate, Arthur Pond. Pond was born in 1705 and acquired some celebrity as a portrait painter, etcher and engraver. He dabbled in science and was elected F.R.S. in 1752 and F.S.A. the same year. Being in easy circumstances he was a great buyer of " rarities " and " curiosities ", especially shells and fossils. He amassed a large and valuable collection, the care of which was, as we have seen, in the hands of Neilson, who was virtually a resident curator. Pond died 9 September 1758, and in the following year his collections were sold.[2]

Edward Wright, M.D., F.R.S., for whom some of Pond's specimens were purchased, was a physician of Edinburgh. He was much interested in natural history and amassed considerable collections of which shells formed a large portion, and these he bequeathed to Edinburgh University.[3] The old University Museum collections were transferred to the Royal Scottish Museum about 1857, so that if all or any of Wright's specimens were still extant at that date they are now presumably incorporated in the national collection of Scotland.

The " Mr. Boydell " who administered Nielson's estate is the well-known engraver and print seller, John Boydell (1719–1804).

" Mr. Hunter " may be either Dr. William Hunter (1718–1783) or his equally distinguished brother, John Hunter (1728–1793), both of whom had large private museums. The collections of the former are now in the Hunterian Museum, Glasgow, and those of the latter passed to the Royal College of Surgeons, London. It is more probable that Neilson's specimens were bought by the former than the latter, whose collections were mainly anatomical and osteological.[4]

Isaac Swainson was born at Hawkshead, Lancashire, in 1746. He became M.D. in 1785 and practised as a physician in London, residing in Frith Street, Soho. He afterwards removed to Twickenham, where he established a botanic garden, for he was interested in all branches of natural history. His large collection of botanical plates is in the herbarium of the British Museum. Isaac, who was a cousin of the well-known zoologist William Swainson (1789–1855), died at Twickenham, 7 March 1812.

Neilson's sale-catalogue was drawn up by George Humphrey, whose name is well known in the annals of conchology. He was a dealer in shells and " curiosities " ; in 1768 his business was carried on at 48 Long Acre and later at Leicester Street, Leicester Square. In 1823 he retired from business when his remaining stock was sold, of which a printed catalogue was issued, and he resided for the rest of his life in Chelsea. He drew up the sale-catalogues of several important collections, including those of Dr. John Fothergill (1781), whose conchological collections were bought by Dr. William Hunter; the Duchess of Portland (1786); Charles Alexandre de Calonne (1797).[1]

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[1] The principal sources of information as to da Costa's career are the many mentions of him in Nichol's *Lit. Anecd.* and *Lit. Illustr.* (for which see the indices to those works) and Sir Henry Lyons, *The Royal Society* 1660-1940 (1944, 169) ; see also *J. Conchol.* **22**, 138.

[2] *D.N.B.* **46**, 76 ; Nichols, *Lit. Anecd.* **5**, 253 ; **9**, 603, 812.

[3] Nichols, *Lit. Illustr.* **4**, 456, 457, 466, 468, 475.

[4] Most of them were lost by enemy action in 1940.

REFERENCES TO THE SPEED OF LAND MOLLUSCA.

By Bernard Verdcourt.

Since the writer's note on this subject appeared (Verdcourt, 1947), Oughton (1948) has published some interesting data. His figures of ·038–·045 cm. per second for various Zonitidæ compare with the writer's figure of ·023 cm. per second for *Oxychilus helveticus* (Blum), which was based on experiments carried out at about 10° C. lower than those of Oughton. He also mentions previous work by Baker, Thomas and Künkel, giving references. A study of the rate of locomotion of land snails from a physiological point of view has been made by Rotarides (1935). Taylor (1900, 348, 349) also gives some data, as follows: Limaces, up to about 0·23 cm. per second; *Pomatias elegans* (Müller), ·042 cm. per second; *Monacha cantiana* (Montagu), 0·125 cm. per second. Further data are given by Pelseneer (1935, 198).

References.

Oughton, J., 1948. A Zoogeographical Study of the Land Shells of Ontario. *University of Toronto Studies*, Biological Studies no. 57.

Pelseneer, P., 1935. *Essai d'Éthologie zoologique d'après l'étude des Mollusques.* Brussels.

Rotarides, M., 1935. Die Schnelligkeit der Lokomotion bei den Landpulmonaten. *Zeitschrift für vergleichende Physiologie* **22**, 564–9.

Taylor, J. W., 1900. *Monograph of the Land and Freshwater Mollusca of the British Isles* **1**, part 6. Leeds.

Verdcourt, B., 1947. The Speed of Land Mollusca. *J. Conchol.* **22**, 269–270.

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[1] Nichols, *Lit. Anecd.* **9**, 813, 816; *Lit. Illustr.* **4**, 773; *J. Conchol.* **20**, 332; **22**, 138. There are two letters from G. H. in the Swainson Correspondence at the Linnean Society. On the Calonne collection see *J. Conchyl.* **74**, 42.

MOLLUSCA OF GRANGE-OVER-SANDS, LANCASHIRE.

By A. and W. THURGOOD.

(*Read before the Society, 18 December 1948.*)

WHILST checking the stock of back numbers of the *Journal of Conchology* in the Society's library at Leeds, attention was caught by the articles dealing with the Mollusca of the Grange-over-Sands neighbourhood, and it occurred to us that it would be interesting to see whether any change had taken place in the fauna as observed by Standen in August 1897, by Jackson and Moore in July 1903 and by Beeston in 1905–1906, so we decided to spend a week at Grange with this end in view. During four or five decades a good many things might happen to alter the character of the habitats and the conditions favourable to the varied molluscan life recorded by these collectors.

In the early part of the week a badly swollen hand due to an insect bite considerably curtailed our activities. However, in Eggerslack Wood we got the following species shown by Standen (1898), Jackson and Moore (1904) and Beeston (1908, 1909) :—

**Vitrina pellucida* (Müller).
Oxychilus cellarius (Müller).
Retinella nitidula (Draparnaud).
Euconulus fulvus (Müller).
Discus rotundatus (Müller).
Hygromia striolata (Pfeiffer).
**Cochlicopa lubrica* (Müller).
Clausilia bidentata (Ström).
Vitrea crystallina (Müller).
Oxychilius alliarius (Miller).
Retinella pura (Alder).
Arion ater (L.).
**Hygromia hispida* (L.).
Ena obscura (Müller).
Lauria cylindracea (da Costa).
Carychium minimum Müller.

* Not recorded by Beeston.

Of the species recorded by Standen only we got *Vallonia pulchella* (Müller). Of those recorded by Jackson and Moore only we got *Vallonia costata* (Müller) and *Cochlicopa lubrica* var. *lubricoides* Férussac. The thing that struck us most was that we did not come across a single *Vertigo* or *Balea*, although we carefully searched lengths of the old walls referred to by Jackson and Moore and by Beeston.

We examined the cliffs on Lindale Road and saw nothing of *Helicella caperata* (Montagu), but got *Helicella virgata* (da Costa) and *Hygromia striolata.*

In the immediate neighbourhod of Kent's Bank village we got :—

Oxychilus alliarius.
Discus rotundatus.
Helicella caperata.
Helix aspersa Müller.
Cochlicopa lubrica.
Lauria cylindracea.
Clausilia bidentata.
Retinella nitidula.
Vallonia pulchella.
Hygromia striolata.
Helix nemoralis L. and var. *rubella* Moquin-Tandon.
Marpessa laminata (Montagu).

We spent a short afternoon at Arnside and on the pitching (railway embankment) got :

Vallonia costata.	*Helicella caperata* and var.
Cochlicopa lubrica.	*ornata* Picard.
Lauria cylindracea.	*Hydrobia ulvæ* (Pennant).

The railway embankment extends from the shore west of Arnside towards the commencement of the viaduct across the upper reach of Morecambe Bay above Milnthorpe Sands. The specimens were taken on the south side of the embankment. The *H. ulvæ* were numerous but dead ; they were amongst dry grass which bore evidence of being covered at times of unusually high tides.

REFERENCES.

BEESTON, H., 1908, 1909. The Land and Freshwater Mollusca of Grange-over-Sands. *J. Conchol.* **12**, 193–208, 241–9.

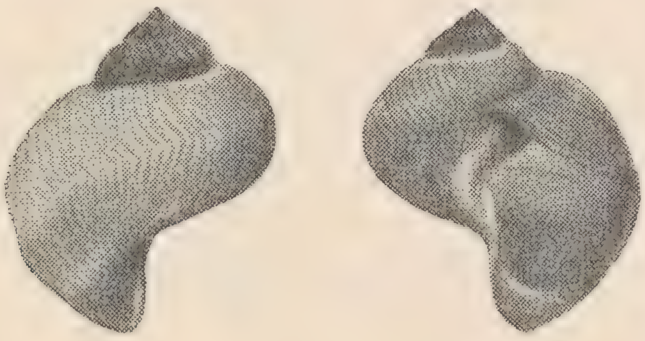
—— 1909. Addenda to Grange Mollusca. *J. Conchol.* **12**, 329–331.

JACKSON, J. W., and MOORE, C. H., 1904. Further observations on the Molluscan Fauna of Grange-over-Sands, Lancs., and district. *J. Conchol.* **11**, 45–7.

STANDEN, R., 1898. Notes on the Land Mollusca of Grange-over-Sands, Lancashire. *J. Conchol.* **9**, 113–14.

Janthina exigua Lamarck in Cornwall.—Jeffreys (*British Conchology* **4**, 1867, 189) observes that " No species of *Ianthina*, except *rotundata*, has been noticed on our shores with the animal, alive or dead, in its shell ". It is therefore of interest to record that a living specimen of *Janthina exigua*, found on Gwenver beach, Sennen, was brought to me by my gardener on 16 January 1949, as well as a specimen of *J. planispirata* Adams and Reeve, complete with float. I searched Gwenver and Whitesand Bay on the following five days and found one perfect *J. exigua* with float on 18 January and two empty shells of this species in good condition on the next day in black drift. I also found nine living *J. planispirata* and a few *Spirula* shells the day after and a few *J. britannica* Forbes and Hanley. Thus with *J. pallida* Thompson (*J. Conchol.* **22**, 267, 307) four different species of *Janthina* have been found at Sennen in the last two years.

T. G. W. FOWLER.



Janthina exigua Lamarck (× 2), Sennen, Cornwall, from original drawings by G. L. Wilkins.

NOMENCLATURE NOTES.

By A. E. Ellis.

Sphærium pallidum Gray and *S. transversum* (Say).

In their note on these species Boycott and Oldham (1938) state that Dr. H. B. Baker had compared English examples of *S. pallidum* with North American *S. transversum* and concluded that they " do indeed seem to be the same species ". Dr. F. Haas has kindly sent me numerous specimens of *S. transversum* from several localities in the United States and I am quite unable to detect any significant difference between them and our *S. pallidum*. Mr. R. Winckworth agrees that they are not separable. *S. pallidum* does not occur on the European Continent, is unknown from any fossil deposits in England, was not recorded as British until 1856 and is confined to canals and canalized rivers. The evidence seems conclusive that it is an alien introduced from North America about a century ago and should be known as *Sphærium transversum* (Say), 1829. American authors place it in the genus *Musculium* Link, 1807, which hardly appears worthy of more than subgeneric status, and *S. transversum* lacks the prominent calyculate umbones which are a salient feature of the type species, *S. lacustre* (Müller).

Pisidium amnicum var. *sulcata* Wood.

Pisidium amnicum var. *sulcata* Wood (1850, 110, pl. 11, fig. 1b) is cited by B. B. Woodward (1913, 27) and Harmer (1914, 43) as a synonym of *P. astartoides* Sandberger, 1880, while Kennard (1944, 154) states that " The valve figured by S. V. Wood is certainly this species and is the type ". If this were true then Wood's name, having thirty years' priority, would be the valid one for this Pleistocene *Pisidium*. Through the kindness of Mr. E. A. Ellis I have recently been able to examine Wood's specimens of *P. amnicum* var. *sulcata* from Grays in Norwich Castle Museum (Register of Fossils, No. 3545): these are all a small trigonal form of *P. amnicum*, similar to those figured by B. B. Woodward (1913, pl. 9, fig. 9) and are quite different from *P. astartoides*. The largest of Wood's shells is that actually figured by him; the following is his description :—

> The specimens from Grays are mostly the thicker variety, in which the posterior side is remarkably short and truncate, and the striæ on the outside are finer and more numerous : this has been called *P. sulcatum* (fig. 1, *b*), but it is, I believe, no more than a variety, as a recent acquisition of numerous specimens show every intermediate alteration to those which are much less inequilateral, and have more distant ridges upon the exterior.

This description, in particular the " finer and more numerous striæ ", could not possibly apply to *P. astartoides*. Sowerby, quoted by Lyell (1840, 363), recognized that " the fossil variety of *P. amnicum*, found at Grays in Essex ", is distinct from the shell figured by Lyell (and named *astartoides* forty years later). This dwarfed, thick, triangular form of *P. amnicum*, with prominent umbones and a broad hinge-plate, is analogous to *P. cinereum* var. *ponderosa* Stelfox, of which it looks rather like a giant form.

Pisidium sulcatum is apparently a manuscript name of Sowerby's. *P. amnicum* var. *sulcata* S. P. Woodward (1864, 6) is presumably *P. astartoides*, though in his collection both this species and strongly striate *P. amnicum* were labelled *P. sulcatum*. It is probable that Sowerby used the name *sulcatum* for *P. astartoides*, to which it is much more applicable, and that Wood confused the "*ponderosa* form" of *P. amnicum* with Sowerby's *P. sulcatum*; both occur at Grays. The point is, however, immaterial, as the shell for which the name was first published is undoubtedly a variety of *P. amnicum*. The earliest valid name for *P. astartoides* appears to be *Pisidium clessini* Neumayr, 1875, *non* Surbeck, 1899; see Wenz (1929).

Volvulus Oken.

The genus *Volvulus* Oken, 1815 (*Lehrbuch der Zoologie* **1**, 313) includes the following species: *V. bidens*, *V. perversus*, *V. muscorum*, *H. trochulus*, *H. aculeata*, *H. detrita*, *H. obscura* and *H. lubrica*. I am not aware of a type ever having been selected. According to Kennard and Woodward, *Volvulus perversus* Oken is synonymous with *Clausilia rugosa*, by which these authors meant *Turbo bidentatus* Ström (= *nigricans* Maton and Rackett), which though a true *Clausilia* is not now regarded as identical with *C. rugosa* Draparnaud. I accordingly select *V. perversus* Oken as the type of *Volvulus*, thus making the name a synonym of *Clausilia* Draparnaud, 1805.

Planorbis præcursor Kennard and Woodward.

This name was used in 1911 (*Geol. Mag.* (5) **8**, 402) for a fossil from the Red and Norwich Crag, but had already been employed by Cossmann (1883, 166, pl. 7, fig. 4) for quite a different shell. As a new name is required for Kennard and Woodward's species, I propose **Planorbis kennardi**, in grateful memory of our leading authority on British post-Pliocene non-marine Mollusca.

REFERENCES.

BOYCOTT, A. E., and OLDHAM, C., 1938. *Sphærium pallidum* Gray and *Sphærium transversum* Say. *J. Conchol.* **21**, 50.

COSSMANN, M., 1883. Description d'espèces du terrain tertiaire des environs de Paris. *J. Conchyl.* **31**, 153–174, pl. 6, 7.

HARMER, F. W., 1914. *The Pliocene Mollusca of Great Britain* **1**. Palæontographical Society.

KENNARD, A. S., 1944. The Crayford Brickearths. *Proc. Geol. Assoc.* **55**, 121–169.

LYELL, C., 1840. On the boulder formation, or drift and associated freshwater deposits composing the mud-cliffs of Eastern Norfolk. *Lond. Edin. Phil. Mag.* (3) **16**, No. 104, 345–380.

WENZ, W., 1929. Zur Geschichte und Verbreitung des *Pisidium clessini* Neumayr. *Arch. Molluskenk.* **61**, 185–9.

WOOD, S. V., 1850. *Monograph of the Crag Mollusca* **2**. Palæontographical Society.

WOODWARD, B. B., 1913. *Catalogue of the British species of Pisidium.* British Museum.

WOODWARD, S. P., 1864. Shells of the newer Pliocene or Norwich Crag. Sheffield (reprinted from White's *History and Directory of Norfolk*).

EDITORIAL NOTES

THE collections of the late Lieut.-Colonel A. J. Peile have now been disposed of according to his written wishes. During his lifetime he had given several hundred slides of radulæ and a collection of Bermudan marine shells to the British Museum (Natural History). The Museum has now received his collection of land and freshwater shells from Bermuda, including recent and fossil *Poecilozonites*, and a volume of drawings of radulæ, with notes, by S. P. Woodward. A valuable series of shells of Streptaxidæ and the Peile collection of radulæ have gone to Edinburgh University. The remainder of his collections, shells, fossils and duplicate radulæ have been distributed among members of the Conchological and Malacological Societies and various institutions. His cabinets have been sold and the proceeds divided between these two Societies.

see p. 92

Mr. R. Winckworth writes : " Among recent papers essential to workers on British marine Mollusca is one by Dr. H. Lemche on Northern and Arctic Tectibranch Gastropoda, *K. Danske Vidensk. Selsk.*, *biol.* **5**, No. 3, 1948, 136 pages, price 18 kr. Dr. Lemche, writing in excellent English, has given an admirable account of work that involves a great deal of careful research on material and literature. The first section on the larval shells is of special interest and well illustrated. The second part, ' A revision of the cephalaspid species,' discusses the species of each genus and gives a full list of synonyms and references under each species. I will here refer to a few points that concern the British fauna. *Diaphana globosa* (Lovén) and *D. expansa* (Jeffreys) are shown to be conspecific with *D. minuta* Brown. *Retusa subcylindrica* (Brown) and *R. nitidula* (Lovén) are combined as one species under the name *R. umbilicata* (Montagu) : the species should, however, be named *R. subcylindrica*, as *Bulla umbilicata* Montagu, 1803, is preoccupied by *B. umbilicata* Röding, 1798. Dr. Lemche asks that *Scaphander* be retained as a *nomen conservandum* in place of the prior *Tricla*, a proposal with which I fully agree. I think the word cephalaspid is unfortunate, as to the general zoologist it suggests an important order of fossil fishes, typified by *Cephalaspis* : there are also objections to the terms anaspid and notaspid as applied to Mollusca. Pelseneer's term Bullomorpha, restricted by the exclusion of pteropods, is available for Cephalaspidea. I hope Dr. Lemche will be able to follow up this excellent work with similar reviews of other opisthobranch orders."

Mr. W. F. Lloyd James writes from Middle Barton, Oxford : " On August 6th I found a scalariform *H. aspersa* on an old wall in the village and on August 24th I took another one in my garden. Both were adult specimens, one considerably larger than the other." Mr. Lloyd James suffered the loss of all his marine collection and Oxfordshire land and freshwater shells in a fire which completely destroyed his house.

Turtox News is a monthly publication sent gratis to teachers of biology by the General Biological Supply House, 761–3 East 69th Place, Chicago 37, Illinois. Volume **24**, numbers 9 to 12, and volume **25**, number 1, contain a series of articles by T. C. Stephens of Iowa on " The Collection and Preparation of Shells ", concluding with a comprehensive bibliography. Volume **26**, number 9, contains the second instalment of an article by P. G. Howes on " North America's Tropical Forest ", in which he refers to a few of the Mollusca of Florida. Of *Liguus* he writes : " These snails are so avidly sought by collectors year after year that some forms are already extinct, while many others are becoming increasingly rare. Whole parties go out after them, hunting through those forest oases raised above the prairies and sands like islands and known as hammocks." These collecting groups " gather them just for fun in as large numbers as possible ". On the prairies and around the sloughs were thousands of *Pila depressa*, mostly empty but unbleached.

An article on " Mussels " in *Turtox News*, volume **25**, number 1, by C. L. Newcombe treats of the habitats, development, conservation and economic importance of *Mytilus edulis* and *Volsella demissus*. During the war the latter species suddenly acquired importance as America's principal natural source of provitamin D. The rôle of the mussel community in checking coast erosion is stressed. In volume **26**, number 7, N. T. Mattox writes on some uses for marine gastropods in Puerto Rico, and describes a shell-dump in the harbour of Parguera 30 feet long and 6 feet high, composed of the shells of four species of *Strombus*, *Cassis tuberosa* and *Cittarium pica*.

Many zoologists will have heard with regret of the death of JAMES HORNELL on 24 February 1949, in his eighty-fourth year. Originally a marine biologist, he will also be remembered for his work on coastal craft of all kinds in the Indian and Pacific Oceans and the volume *Water Transport* (1946). He was a Fellow of the Linnean Society and of the Royal Anthropological Institute : but, although interested in Mollusca, he never became a member of the Conchological Society. While in Jersey he published some short papers on Mollusca in the *Journal of Marine Zoology* (1893–6). In 1902 he went to Ceylon where, as assistant to Professor W. A. Herdman, he was responsible for the bulk of the work on the Ceylon pearl oyster fisheries. The results were published in five volumes by the Royal Society as a *Report on the Pearl Oyster Fisheries of the Gulf of Manaar* (1903-1906). This report contains some important papers on parasites by Shipley and Hornell, in which they were able to show the strong probability that most pearls in *Pinctada vulgaris* are due to a cestode, *Tetrarhynchus unionifactor*, which is found in its larval stages in the pearl oyster and in adult form in the eagle ray, *Rhinoptera javanica*. Hornell was Director of Fisheries to the Government of Madras from 1907 to 1924. Among his publications in the *Madras Fisheries Bulletin* are " The Sacred Chank of India " (No. 7, 1914), " Edible Molluscs of South India " (volume **11**, 1917), and " Common Molluscs of South India " (volume **14**, 1922). He also wrote on the Indian varieties and races of the genus *Turbinella* (*Mem. Indian Mus.* **6**, 1916). Among the papers in his *Report . . . on the Marine Zoology of Okhamandal* (1909), one gives an account of the anatomy and economic uses of the window-pane oyster, *Placuna placenta* (L.), and another records the presence of symbiotic algæ in the pelagic nudibranch, *Melibe*. One of his last appointments as an adviser on fisheries was to the Seychelles Islands. In his later years he lived at St. Leonards-on-sea.

R. WINCKWORTH.

Kew Bulletin, 1948, number 1, 113–124, contains the 20th supplement to " The wild fauna and flora of the Royal Botanic Gardens, Kew ", published in 1906. The 5th supplement (1907) dealt with Mollusca. In the latest supplement, page 120, Dr. A. D. J. Meeuse gives a list of the alien Mollusca found at Kew. There are two new records : *Zonitoides* (*Zonitellus*) *arboreus* (Say), a North American species, and *Agriolimax laevis sandwichiensis* (Souleyet), a tropical subspecies. *Z. arboreus* is known also from Edinburgh, Cambridge and Northwich, Cheshire, and a *Zonitoides* found at Glasnevin near Dublin and at Belfast was tentatively identified as this species (*Proc. Roy. Irish Acad.* **29**, B, 1911, 133). *Lamellaxis* (*Allopeas*) *clavulinum* (Potiez and Michaud), previously recorded from Nottingham, inhabits the fern-house at Kew, where *Opeas pumilum* (L. Pfeiffer) [= *Bulimus clavulus* Turton] has been known since 1905. The last species has long been regarded as synonymous with *Helix goodallii* Miller [*non H. goodalli* Férussac], but three shells in my possession from W. W. Walpole's collection labelled " *Bulimus goodallii*, original specimens, Miller's nursery, Bristol ", comprise, as Mr. Hugh Watson has pointed out, two different species : *Subulina octona* (Bruguière), a species recorded from Kew in 1884, and a specimen similar to some collected by Mr. A. R. Waterston in the Glasgow botanic gardens and identified by the late Major Connolly as *S. petrensis* (Morelet) from Sierra Leone. I have verified Connolly's determination by comparison with Morelet's paratypes in the British Museum, and have taken the same species in the palm house at Kew.

According to Pilsbry, *petrensis* is a variety of *S. striatella* (Rang), figured in *Manual of Conchology* (2) **18**, pl. 11, f. 89–92. Alien Planorbidæ found by Mr. B. Verdcourt at Kew were identified by Dr. H. A. Pilsbry as *Helisoma doryi* (Wetherby) and *H. eudiscus* Pilsbry. Mr. Verdcourt informs me that Dr. Meeuse has found *Lymnæa* (*Pseudosuccinea*) *columella* Say at Edinburgh, and a *Lymnæa* which Mr. Hugh Watson collected some years ago in the Cambridge botanic gardens agrees closely with Baker's description and figures of *L. rustica* Lea, which he regards as a subspecies of *L. humilis* Say.

The first number of the new *Journal of the Bedfordshire Natural History Society and Field Club* contains a paper by B. Verdcourt on " Additions to the knowledge of Bedfordshire Mollusca ". The following are new county records : *Aplexa hypnorum* (L.), *Oxychilus draparnaldi* (Beck), *Milax gracilis* (Leydig), *Pisidium obtusale* (Lamarck). The Editor would be glad to receive copies of papers on Mollusca published in the journals of natural history societies, so that attention may be drawn to records and observations which are apt to be overlooked.

L. W. Stratton has a paper on " Flood debris from the River Colne " in the *Transactions of the Herts Natural History Society* **23**, 1948, 24–9. In a gallon of debris he found 2,795 shells, comprising fifty-seven species. The next year (1947) in the same quantity of material he took over a thousand fewer shells, and though the freshwater shells were less than a third of the 1946 bag, the land shells were three times as many. This is explained by the extensive floods of 1947 distributing the freshwater shells over a wider area, and at the same time washing out more land snails from the herbage.

The London Naturalist, No. 27 (1948), has short papers on the freshwater Mollusca of Bookham Common, Surrey, by C. J. F. Bensley, and on the land Mollusca by A. E. Ellis. Colonel Bensley has made a special study of seasonal fluctuations in the numbers of selected species in ponds on the Common.

Mr. J. R. le B. Tomlin is to be congratulated on being appointed a Governor of the National Museum of Wales, and also an Associate of the British Museum ; the latter is understood to be a unique distinction. Dr. A. T. Hopwood is the Zoological Secretary of the Linnean Society of London.

One of the problems with which an Editor is repeatedly confronted is the mournful one of composing obituary notices. The difficulty of obtaining biographical details for this last tribute to the memory of departed members is often great, as the subject of the notice is no longer in a position to supply the required information, and it is not always possible to glean all the data one would wish from other sources. Without morbidity we must recognize the inevitable fact that all are mortal, and the time will eventually come when each one of us qualifies for inclusion in the obituary pages. It would be of inestimable help if members would overcome their natural diffidence and furnish the Editor for filing with such biographical particulars as are customarily mentioned in this connection, namely : (*a*) full name, (*b*) date and place of birth, (*c*) parentage, (*d*) education, degrees, distinctions, etc., (*e*) profession and career, (*f*) date of marriage and wife's maiden name, (*g*) children, (*h*) publications, (*i*) interests, hobbies and activities, (*j*) any other personal particulars, associations or reminiscences of general interest. All this may be rather too suggestive of an official form, but the Editor's task would be greatly lightened if such biographical material were readily available, and members would be assured of accuracy in the compilation of notices which, in the nature of things, they will not be able to criticize or emend.

The Rev. Henry Purefoy Fitzgerald, M.B.E., M.A.(Oxon.), F.L.S., F.C.S., J.P., a life member of the Conchological Society, elected in 1884, died on 5 December 1948 aged 81. An account of his life appeared in the *Hampshire Chronicle* and an obituary notice is expected to be published in the *Proceedings of the Linnean Society*. Our President, Mr. Tomlin, who was elected in 1886, now becomes the " father of the Society ". An obituary notice of Walter Edward Collinge, D.Sc., M.Sc., who died on 24 November 1947 at the age of 80, will be published in the *Proceedings of the Malacological Society* ; he was elected a member of the Conchological Society in 1898 and was President 1906–1908.

The Scarborough Field Naturalists' Society is bringing out a *Natural History of the Scarborough District*, under the editorship of G. B. Walsh, B.Sc. This will consist of sections compiled by competent local naturalists, with the help of specialists in each branch of knowledge, and will be as up-to-date and thorough as possible. Among the names of naturalists connected with Scarborough those of William Bean, John Leckenby, W. J. Clarke and W. Gyngell are familiar to conchologists. The subscription price of the book is one guinea, which is below publication cost ; the treasurer is Mr. J. P. Best, 26 Woodland Ravine, Scarborough. The advance notice modestly claims that " the book will be one of the best of its kind ever published in Britain ".

Early Khartoum by A. J. Arkell (Oxford University Press) gives a full description of the hitherto unknown culture of a hunting and food-gathering people of probably mesolithic date. Mr. J. R. le B. Tomlin uses the Mollusca for evidence as to the climate of the period.

Mr. E. W. Swanton retired in 1947 from the curatorship of Haslemere Educational Museum, having held this post since 1897. Tributes were paid, at a conversazione held to celebrate Mr. Swanton's jubilee, to his life's work in building up this excellent museum, " a living place, playing an important part in education, particularly of the younger generation " (*Haslemere Herald*, 14 November 1947), and the full story of the rise and progress of this now famous institution is told in his book, *A Country Museum*. Mr. Swanton was elected a member of the Conchological Society in 1895 and was President in 1922. His *Pocket Guide to the British Non-marine Mollusca* was published in 1906 and *The Mollusca of Somerset* in 1912 ; of the latter Boycott wrote, " The œcological introduction is simply splendid, just the work which wants doing so badly." The M.B.E. was conferred on Mr. Swanton in 1936 and the O.B.E. last year in recognition of his educational work at Haslemere. His successor is Lieut.-Colonel C. J. F. Bensley, who is also a member of this Society and particularly interested in the ecology of non-marine Mollusca.

A series of illustrated articles by B. Verdcourt on the radulæ of British non-marine Mollusca has been appearing in *The Microscope*, starting June 1946. The species so far dealt with are all Prosobranchia.

Mr. A. E. Salisbury sends the following interesting notes on the Jeffreys collections, wherein a good deal that we did not know is brought to light: During some recording work notes were made from an issue of the *Smithsonian Miscellaneous Collections* **104**, No. 15, 1946, 1–96, entitled " A Bibliography and short

Biographical Sketch of William Healey Dall" by P. Bartsch, H. A. Rehder and B. E. Shields. This may have escaped the notice of many readers of this *Journal*, to whom it is of interest in quoting excerpts from letters of J. G. Jeffreys bearing on his British and other collections, which incidentally should never have been allowed to leave this country. As the publication cited above is not available to many of our members it may be permissible to quote the pertinent extracts.

Jeffreys' letter to Dall, 7 January 1882 :

" Now a few words as to my collections of shells. I simply regard them as a workman's tools, and after my work is finished I would dispose of the collections for a fair price. They have cost me a considerable sum altogether, viz. upwards of £2,000. I value them at £1,050, one thousand guineas, and I should be glad to have them available for scientific purposes."

Again on 29 May 1882 he wrote giving a general statement of the contents of the collection, as follows :—

1. A perfect and unique collection of British Mollusca containing about 700 species, being all the species which have been described or recorded. It comprises every species given in Mr. Gwyn Jeffreys' work on *British Conchology* and in his subsequent papers on the subject, as well as the original collections of Dr. Turton (the author of the *Conchological Dictionary* and other publications), of the late Mr. Clark (the author of *A History of the British Marine Testaceous Mollusca*) and some types of Col. Montagu (author of *Testacea Britannica*) and of other well known conchologists. The rare species are amply represented and altogether the specimens number considerably more than 10,000, perhaps 100,000.
2. A collection (supposed to be complete) of Mediterranean shells, including those of Herr Weinkauff (the author of *Conchylien des Mittelmeeres*) and many rare species received from other writers on Mediterranean shells.
3. A collection (believed to be complete) of Scandinavian marine shells including types of Professors M. and G. O. Sars and Professor Lovén.
4. A collection of Arctic shells, including types of Mr. Reeve, Professor Torell, Mr. Albany Hancock and others.
5. A collection of shells from various other parts of the European seas, including several of the new species procured by the French expedition of 1880 in the Bay of Biscay and several undescribed species.
6. Types of species (chiefly *Rissoa*) described and figured by the Rev. R. B. Watson from Madeira.
7. A small collection of North American shells including types of Professor Stimpson.
8. Collections of land and freshwater shells from the Continent, United States, Madeira and St. Helena, including types of authors.
9. Collections of marine shells procured during the Expeditions of H.M.S. *Lightning*, *Porcupine*, *Shearwater*, *Valorous* and *Knight Errant*.
10. Some marine shells of scientific interest dredged in North Japan and from other parts of the world, as well as a few duplicates from the *Josephine*, Pourtales and *Challenger* expeditions.
11. A collection of British Cirripedes, many of them named by the late Mr. Darwin.
12. An extensive collection of Tertiary and post-Tertiary shells from the English Crag, Italy, France, Great Britain and Scandinavia.

From all the above it would seem that Jeffreys had much of the collections of men such as Lovell Reeve, the destination of whose collection has been in doubt, and it is evident from Jeffreys' estimate of what the shells cost him that he had bought largely and whenever a collection was to be obtained ; anyhow Jeffreys did not confine himself to British or even to European seas.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

686th Meeting held at Yattendon Court, Berkshire, 2 October 1948.

Mr. A. E. Salisbury, Vice-President, in the chair.

The Chairman moved a vote of thanks, which was passed with acclamation, thanking Lady Iliffe for her hospitality in inviting members of the Society to luncheon and to hold a meeting at Yattendon Court. Lady Iliffe's collection, which was on view, includes that of the late Rev. E. G. Alderson, who published a book illustrating his collection of *Pila* (*Ampullaria*), fifteen copies of which were hand-coloured by the author. Mr. T. Pain commented upon the various species represented in the collection and called attention to examples of *Pila* of particular interest.

Elected to Membership.

The Lady Iliffe, Yattendon Court, Newbury, Berkshire.

After the meeting Lady Iliffe conducted the members around the grounds and conservatories, and then entertained the company to tea and provided conveyances to Reading Station.

687th (Annual) Meeting held in the Board Room at the British Museum (Natural History), 18 December 1948.

Mr. J. R. le B. Tomlin, President, in the chair.

Election of Scrutineers.

Mr. L. W. Stratton and Mr. T. Pain were elected Scrutineers.

Election of Auditors.

Mr. C. P. Castell and Mr. G. L. Wilkins were elected Auditors for 1949.

Election of Members.

The following were elected to membership of the Society :—

Mr. David E. Brown, 91 Fellows Road, London, N.W. 3.
Mr. A. G. Davis, F.G.S., 75 Croydon Road, Anerley, S.E. 20.
Mr. Ian T. Fleming, 8 Mount Road, Rhyl, Flintshire.
Mr. M. B. Heywood-Waddington, Malvern House, Maltravers Road, Littlehampton, Sussex.
Mr. H. F. Jones, 67 Tantallon Road, Balham, S.W. 12.
Vítĕrslav Fr. Hlaváč, Klášler nad Dĕd, p. Bolehost, Czechoslovakia.
Mr. H. J. Koch, P.O. Box 1122, Johannesburg, Transvaal, South Africa.
Señor J. J. Parodiz, Museo Nacional de Historia Natural, Buenos Aires, Argentina.

The Hon. Treasurer made an interim statement of finances up to date and it was resolved that the accounts up to the end of the year be published in the *Journal* when audited.

The President announced that as the result of the ballot the nominations printed on the ballot papers were all approved (see page 25).

Reports of the Council, the Yorkshire and North Staffordshire Branches, and the Recorders for marine and non-marine Mollusca were presented and adopted.

The following papers were read in title :—

" The Mollusca of Grange-over-sands, Lancashire," by A. and W. Thurgood.

" The Mollusca of the Leeds Naturalists' Club and Scientific Association's Area," by W. Thurgood.

" Some Eighteenth Century Conchologists," by Warren R. Dawson.

" *Charonia lampas* (L.) in the Lower Littoral Zone," by B. S. Kisch.

"A new name for *Leuconia* Gray," by R. Winckworth.
"Abnormal radula of *Lymnæa truncatula* (Müller)," by B. Verdcourt.

The President exhibited a selection of photographs of Conchologists on which he made some comments. A vote of thanks to the President was unanimously passed for this acceptable variant of a formal address.

Exhibits.

By the President, Mrs. McMillan, Mrs. Morehouse, Mr. J. H. Lumb and Mr. A. E. Salisbury: photographs of conchologists.

By the President: species of *Epitonium* and *Liguus*.

By Mr. T. Pain: specimens illustrating variation in *Burtoa nilotica* (L. Pfeiffer).

By Mr. G. L. Wilkins: a series of *Pinna*.

By Mr. D. E. Brown: *Subulina* ? *striatella* (Rang) from a colony living in the reptile house in the Zoological Gardens (one example 29 mm. in height).

By Mr. A. E. Salisbury: some British species of Eulimidæ.

By Mr. B. Verdcourt: photographs to show the differences between *Carychium minimum* Müller and *C. tridentatum* (Risso); photographs of the jaw of *Valvata piscinalis* (Müller), dart of *Zonitoides excavatus* (Alder) in ordinary and polarized light, sections of jaw of *Pomatias elegans* (Müller), embryonic shell of *Testacella maugei* Férussac, and apex of juvenile shell of *Vitrina pellucida* (Müller) showing sculpture; specimens of *Lymnæa* (*Pseudosuccinea*) *columella* Say; two North American planorbids from the Royal Botanic Gardens, Kew.

By Mr. L. W. Stratton: *Clausilia rolphii* Turton from Bedfordshire; *Oxychilus draparnaldi* (Beck) from Isle of Wight.

Annual Report of the Council.

THE membership of the Conchological Society now stands at 150, comprising 148 ordinary and life members and two honorary members, namely the President and Dr. H. A. Pilsbry. We have to deplore the loss of several well-known workers who were members of the Society; Professor T. D. A. Cockerell, Dr. W. E. Collinge, Mr. A. S. Kennard and Lieut.-Colonel A. J. Peile.

Mr. J. R. le B. Tomlin has retired from the editorship of the *Journal* after forty years' devoted service and is succeeded by Mr. A. E. Ellis. Two numbers of the *Journal* were issued in 1948: volume **22**, number 12, edited by Mr. Tomlin, 31 May, and volume **23**, number 1, edited by Mr. Ellis, 19 November.

Mr. W. Thurgood, to whom the thanks of the Society are due, has given a great deal of time to the task of sorting and arranging the Society's library, now at Leeds.

The Council expresses the gratitude of the Society to the authorities of the Leeds City Museum for providing accommodation for the library and cabinets, and to the Trustees of the British Museum (Natural History) for permission to hold the Annual Meeting in the Board Room.

Report of the Yorkshire Branch (Yorkshire Conchological Society).

ANNUAL Report presented by the Hon. Secretary, W. Thurgood, to the 52nd Annual Meeting of the Yorkshire Conchological Society, held on 2 October 1948 in Geology House, Hillary Place, Leeds.

The first meeting of the year was held on 13 March. An exceedingly interesting talk was given by Miss K. M. Morehouse, B.Sc., her subject being "Comparative Anatomy and Embryology of the Mollusca". The speaker dealt with all the classes of the phylum, the lecture being illustrated by means of sketches shown on the epidiascope. Mrs. McMillan, Hon. Secretary of the Conchological Society, was present at the meeting. An excursion to Wentbridge was made on 12 June. The leader, Mrs. E. M. Morehouse, brought along the President and about twenty members of the Doncaster Scientific Society. Twenty species were taken or noted. A small number of members turned up on 24 July for the excursion to Askham Bog, York. The conditions were most unfavourable on account of the dry state of the bog and surrounding ditches, due to the continued dry weather and the effect of a drainage scheme. One specimen of *Succinea pfeifferi* Rossmässler (det. H. E. Quick) was taken in the Bog. On the side of the York–Leeds road, just outside the entrance to the Bog, five terrestrial species were taken or noted.

W. THURGOOD.

Report of the North Staffordshire Branch.

OUR members are still keen workers on the North Staffordshire Mollusca. No new species has been reported during the past year. On 16 October I located a small colony of *Helicella caperata* (Montagu) at Whistoneaves, near Oakamoor, a hitherto unrecorded locality. Both adult and young snails in various stages of growth were obtained, in association with *Discus rotundatus* (Müller), *Hygromia striolata* (C. Pfeiffer), *Oxychilus alliarius* (Miller) and *Cochlicopa lubrica* (Müller). I also picked up a dead *Limax maximus* L., a victim of the frost. In a garden at Stone I obtained two adult *Milax gracilis* (Leydig) ; immature individuals were plentiful. Stone is seven miles south of Normacot, where I have previously reported the occurrence of this slug.

B. BRYAN.

Recorder's Report : Marine Mollusca.

Very little progress is possible unless members send in more lists of their own captures and of species existing in museums and other collections. A new helper, the Rev. Canon L. W. Grensted, D.D., of Oriel College, has promised assistance in the future and meanwhile has sent some information about species at Red Wharf Bay, Anglesey (Region X). He noted that he remembers seeing several species living that have previously been marked on their maps. He sent a remarkably distorted cockle ; it was a right valve, very dead. I was forced to conclude that it was *Cardium aculeatum* L., a species for which we have no record for Region X. The distortion seems to have been caused by the infestation of a Nematode ; it was similar to the thickening of the nacreous layer which I observed in *Patella vulgata* L. at Maen Porth, Falmouth, many years ago ; this thickening had certainly been caused by these worms. In this cockle the chief feature of the distortion was the remarkable production of the posterior margin.

Mr. A. E. Ellis has sent the following information new to the maps : *Otina ovata* (Brown), Clackland Point, Cumbrae and Arran (Region XII), from *Handbook on the Natural History of Glasgow and the West of Scotland*, 1901.

I feel that the time has come when a publication of the Marine Census, similar to that of the Land and Freshwater, should be undertaken.

ALAN P. GARDINER.

Recorder's Report : Non-marine Mollusca.

Scilly Isles (1*a*) : *Lymnæa truncatula, Succinea pfeifferi, Vertigo pygmæa, Vallonia excentrica, Oxychilus cellarius, Retinella radiatula, Vitrina pellucida, Arion subfuscus, A. hortensis, Milax gagates,* G. C. Robson and O. W. Richards, 1926.

West Cornwall (1) : *Euconulus fulvus,* G. C. Robson and O. W. Richards.

South Devon (3) : *Testacella scutulum,* Exeter, A. E. Ellis.

South Hampshire (11) : *Viviparus viviparus,* A. S. K.

North Hampshire (12) : *Vallonia excentrica,* A. S. K.

East Sussex (14) : *Pisidium pseudosphærium* (see page 27).

East Kent (15) : *Cochlicella acuta,* Saxon period, West Hythe, comm. C. P. Castell.

West Kent (16) : *Viviparus fasciatus, Vertigo pygmæa,* A. S. K.

Surrey (17) : *Acme fusca* (*lineata*), Mickleham, *Milax gagates,* Epsom, A. E Ellis.

South Essex (18) : *Helicella gigaxii*, A. S. K.

East Suffolk (25) : *Dreissena polymorpha*, Lake Lothing, Edward A. Ellis.

West Suffolk (26) : *Vertigo angustior*, A. S. K.

East Norfolk (27) : *Phytia myosotis*, Great Yarmouth, E. A. Ellis.

West Norfolk (28) : *Hydrobia ventrosa*, King's Lynn to Heacham, *H. jenkinsi*, King's Lynn, E. A. Ellis ; *Vertigo angustior*, *Helicigona lapicida*, A. S. K.

Bedford (30) : *Clausilia rolphii*, Deadmansey Wood, L. W. Stratton ; *Sphærium rivicola*, River Ouse, Bedford, B. Verdcourt.

Warwick (38) : *Lymnæa glabra*, A. S. K.

Glamorgan (41) : *Milax sowerbii*, Swansea ; *M. gagates*, Swansea, Porthcawl, H. E. Quick.

Brecon (42) : *Vitrina major*, Priory Woods, Brecon, H. E. Quick (not a new county record).

Pembroke (45) : *Arion ater* s.s., Skokholm, Miles Williams, det. H. E. Quick.

Denbigh (50) : *Lauria anglica*, Gresford (correction) ; *Phytia myosotis*, Foryd, I. T. Fleming.

Flint (51) : *Hydrobia jenkinsi*, *Planorbis carinatus*, *P. vortex*, Ysceifiog, *Helicella itala*, Ddôl, near Caerwys, J. O'Neil Millott ; *Phytia myosotis*, Talacre, Mrs. N. F. McMillan ; Rhyl, I. T. Fleming ; *Sphærium corneum*, Rhyl, I. T. Fleming.

Leicester (55) : *Milax sowerbii*, Market Harborough, A. E. Ellis, 1922.

Cheshire (58) : *Acme fusca*, Holocene, Patrick's Wood, Bromborough, Mrs. N. F. McMillan ; *Oxychilus draparnaldi*, A. S. K.

West Lancashire (60) : *Unio tumidus*, A. S. K.

South-east Yorkshire (61) : *Sphærium rivicola*, A. S. K.

North-west Yorkshire (65) : *Pisidium milium*, Richmond, J. O'N. Millott.

Westmorland (69) : *Viviparus fasciatus*, Scales Tarn (introduced), T. T. Macan.

Isle of Man (71) : *Phytia myosotis* var. *denticulata*, Port Erin, *Leucophytia bidentata*, Port St. Mary, J. O'N. Millott.

Mid Ebudes (103) : *Vertigo pygmæa*, *V. alpestris*, *Acanthinula aculeata*, *Retinella pura*, *Oxychilus helveticus*, *Hygromia hispida*, *H. striolata*, *Helicella caperata*, Isle of Mull, L. B. Langmead ; [also *Limax maximus* and *Milax sowerbii*, but specimens not submitted]. See page 41.

Tyrone (118) : *Pisidium obtusale*, Holocene, Killymaddy Lough, comm. J. W. Jackson.

The initials A. S. K. signify that the record was authenticated by the late Mr. Kennard.

The discovery of *Vertigo alpestris* Alder on the Isle of Mull is of exceptional interest, being the first Scottish record for this species which, except for an outlying station in Merioneth, has hitherto been known in the British Isles only from the north of England. Now that its presence in Scotland has been detected, it is hoped that search will be made for this species in other parts of that country. The evidence of the former occurrence of *Cochlicella acuta* in East Kent is also noteworthy ; it is known living in the county only from near Greenhithe, where Major J. P. T. Burchell found it fifteen years ago, though it now seems to have died out.

A new edition of the Census is being prepared, it being 28 years since the last complete edition was published. Members who have any new records not yet printed in the supplements to the Census are requested to communicate them to the Recorder. The distribution of certain critical species, which have only recently been recognized in the British Isles, is very incompletely known. These are as follows : *Arion rufus* (L.), recorded from Cambridge and Glamorgan, and *A. ater* s.s. (*J. Conchol.* **22**, 1947, 249) ; *Agriolimax agrestis* (L.), so far recorded only from the Norfolk Broads, the common slug until recently known by this name being *A. reticulatus* (Müller) ; *Agriolimax caruanæ* (Pollonera), recorded from South Devon and Glamorgan ; the three species of *Milax* (considerable progress has already been made) ; *Vitrina major* (Férussac) ; *Carychium minimum* (Müller) and *C. tridentatum* (Risso) ; *Succinea elegans* (Risso), recorded from East Norfolk and Hertford (formerly confused with *S. pfeifferi* Rossmässler) ; *Succinea arenaria* Bouchard-Chantereaux, recorded from North Devon, Queen's County (Leix), King's County (Offaly), West Mayo and North Tipperary (previously confused with *S. oblonga* Draparnaud). As precise determination of the critical species of *Vitrina*, *Succinea* and slugs necessitates dissection of the animal, specimens should be sent alive, or preserved in 70 per cent alcohol, to Dr. H. E. Quick, 130 Eaton Crescent, Swansea. Shells for authentication should be sent to the Recorder.

When submitting specimens for the Census records the following data should be supplied: (*a*) locality clearly written, preferably in block letters, or typed; illegibility is a not infrequent source of error; (*b*) name and number of vice-county; (*c*) whether the shells were living or dead, and if the latter, whether they appeared to be recent or subfossil (Holocene). In the case of rare species new localities are worth recording, even though the species has previously been authenticated for the particular vice-county, and Holocene records are of interest for areas where the species has not been found living. Records are also desired for certain littoral species, namely *Otina ovata* (Brown), *Acmea subcylindrica* (L.) and *Paludinella littorina* (Chiaje), and also for introduced aliens.

Supplements to the 1921 edition of the Census (**16**, No. 6) were published in the *Journal* as follows: **16**, 273; **17**, 27, 122, 223; **18**, 28, 82, 182, 299; **19**, 30, 123, 184, 344; **20**, 27, 156, 187, 313; **21**, 29, 216, 254, 284, 337; **22**, 95, 311.

A. E. Ellis.

Viviparus fasciatus (Müller) in the Lake District.—Scales Tarn lies on Claife Heights, 650 feet above sea-level, between Windermere and Esthwaite Water; although politically in Lancashire it is within the Watsonian vice-county of Westmorland (69). The tarn is rather more than an acre in extent and about eight feet deep at its deepest part. It is an artificial fishpond and was drained and refilled in 1938. In 1939 it was heavily stocked with *Lymnæa peregra* purchased from some hatchery and presumably the consignment contained a few *Viviparus fasciatus*. The interesting thing is that the latter have survived and done quite well, for when the tarn was drained again in December 1948 they were found in fair numbers Some are of quite large size though many are badly eroded. I have just completed a series of observations on the calcium content and alkalinity of Lake District tarns, but unfortunately have no data for Scales Tarn because it was dry when I started the investigation in 1938.

T. T. Macan, *Freshwater Biological Association, Wray Castle, Ambleside.*

Lymnaea stagnalis (L.) killed by radular action.—In January 1949 I transferred about twenty *Lymnæa stagnalis* and about as many *Planorbis* (*Coretus*) *corneus* (L.) from the pond on the village green at Chiddingfold, Surrey, to a glass tank indoors. The only vegetation in the tank was some *Elodea canadensis* and the bottom was covered with small pebbles. The next day I noticed that the snails appeared to be browsing on each other especially on the *L. stagnalis*, so I left them to see what would happen. In less than a week the shells of two *L. stagnalis* had been rasped through and two others were soon perforated; the body protruded through the hole and the animals soon died. The other snails did not feed upon the dead body which was just left to decompose. Both species took part in these attacks, which were almost confined to the *L. stagnalis*, presumably because both shape and texture of the shell were more suitable. After a day or two the dead shells were left alone, neither did the snails attempt to eat some dead shells of *L. peregra* which were already in the tank. I put some cabbage leaves in the tank and the cannabalistic attacks stopped at once.

C. J. F. Bensley.

OBITUARY NOTICE.

H. R. WAKEFIELD, 1861–1948.

HARRY ROWLAND WAKEFIELD was born 20 November 1861 at Birmingham and died 24 June 1948 at Bawdrip, Somerset. He was the son of John and Lucy (née Passey) Wakefield, both of Birmingham, and in 1885 married Elizabeth Cross. They had four daughters, two of whom inherited his scientific bias : Elsie Maud, the eldest, now mycologist at the Royal Botanic Gardens, Kew, and Florence Ethel, the youngest, who before her marriage was lecturer in applied science at the Yorkshire College of Household Science, Leeds.

Wakefield was educated at King Edward VI Grammar School, Birmingham, and Borough Road Training College, London. In 1883 he was appointed assistant science demonstrator under the Birmingham School Board, from 1889 to 1914 was chief science demonstrator to the Swansea School Board, and from 1914 to 1931 Juvenile Employment Officer for Swansea. He was elected a member of the Conchological Society in 1898.

A keen naturalist from boyhood, Wakefield while at school collected Lepidoptera and plants, later becoming interested in shells (especially land and freshwater), insects (particularly beetles), fossils and minerals. On leaving Swansea in 1936 he gave his geological collections to University College, Swansea, and his shells and general collection of insects to the Royal Institution of South Wales, Swansea. The Coleoptera he retained, and collected in the neighbourhood of his home in Somerset up to a year or two before his death. His publications included *Earth Knowledge* (1888, jointly with Jerome Harrison), *Elementary Hygiene* (1897), *Lessons on Living* (1905), and several entomological papers in *Proc. Swansea Sci. & Field Nat. Soc.* He was the prime originator of the Swansea Field Naturalists' Society in 1906 and was made the first Life President of the combined Swansea Scientific and Field Naturalists' Society in 1931.

Wakefield was a good lecturer and much in demand for popular lectures on natural history subjects. He was also an efficient organizer and was joint secretary of the Children's Home at Llangennith. He was fond of music and for many years sang in the choir of Walter Road Congregational Church, Swansea, of which he later became deacon. After natural history his chief love was gardening and he worked to the last in the beautiful garden he made out of a bare field at Bawdrip, passing away suddenly as he was starting his task in the garden on midsummer day.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1948.

Income and Expenditure Account.

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
For 1948	50	14	0			
Paid in 1947	1	4	0			
Arrears	10	0	0	61	18	0
,, Sales				60	1	1
,, Transfers from Life Membership Fund	20	10	0			
,, Research Fund	11	4	0	31	14	0
,, Donation (Mr. Thurgood) to cost of Seal and labels					16	9
,, *Deficit* being amount of Income below Expenditure				35	8	2
				£189	18	0

Cr.

	£	s.	d.	£	s.	d.
By Publication and distribution—						
Vol. 22, part 11	50	7	6			
,, ,, ,, 12	55	18	7			
,, 23 ,, 1	60	9	7	166	15	8
,, Printing and Stationery				4	2	0
,, Fire Insurance				1	12	6
,, Zoological Record					8	0
,, Cheque Book and Charges					5	2
,, Seal and Labels					16	9
,, Meeting Room				1	0	0
,, Officers' Expenses				14	17	11
				£189	18	0

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1948	472	6	0
,, Dividends and Interest	20	10	0
	£492	16	0

	£	s.	d.
By Transfer to Income and Expenditure Account	20	10	0
,, Amount of Fund, 31 December 1948	472	6	0
	£492	16	0

Research Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1948	256	16	0	By Transfer to Income and Expenditure Account	11	4	0
,, Dividends and Interest	11	4	0	,, Amount of Fund, 31 December 1948	256	16	0
	£268	0	0		£268	0	0

BALANCE SHEET.

LIABILITIES.

	£	s.	d	£	s.	d.
Annual Subscriptions in advance				8	4	0
Life Membership Fund				472	6	0
Research Fund				256	16	0
Transfer from Research Fund				100	0	0
Balance, Income and Expenditure Account—						
As on 1 January 1948	238	9	6			
Less Deficit for 1948	35	8	2	203	1	4
				£1,040	7	4

ASSETS.

	£	s.	d.	£	s.	d.
4% Funding Loan (cost)				350	0	0
2½% Defence Bonds (cost)				200	0	0
3½% War Loan (cost)				40	0	0
Cash at Bankers—						
National Provincial	57	8	4			
Post Office Savings Bank	382	19	0			
In hand	10	0	0	450	7	4
				£1,040	7	4

NOTE.—Assets in addition to those set out in the above Balance Sheet are (*a*) Library, (*b*) Cabinets and Collections, (*c*) Stock of unsold publications, (*d*) Annual Subscriptions in arrears.

Audited and found correct.
A. TINDELL HOPWOOD.
C. P. CASTELL.
3 March 1949.

ALBERT E. SALISBURY,
Hon. Treasurer.
21 February 1949.

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THE

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A Systematic, Fully Illustrated Monography of Recent Mollusks.

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It is believed that students of the Mollusca will find material of value to them in these volumes, whether they are interested in species of the world, or in those of a local fauna.

In the later volumes the **fossil forms** also, of the genera dealt with, are classified and listed.

Inquiries and subscriptions may be addressed to :—

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And also of the Secretary of the Society

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SUBSCRIPTIONS became due on 1 January and Members who have not already done so are asked to remit to the Hon. Treasurer without further delay. Those who are in arrears by more than a year cannot expect to receive copies of the *Journal* until their subscription is paid. Members are reminded that the annual subscription is now £1. The mounting cost of printing makes it essential that subscriptions should be promptly paid if the *Journal* is to be published at regular intervals. At present it is financially prohibitive to produce more than two numbers a year. Donations towards the cost of Publication would, of course, be gratefully welcomed by the Hon. Treasurer.

SLUGS REQUIRED FOR RESEARCH

Specimens of *Arion ater* (L.) and *A. rufus* (L.) and varieties from as many different localities as possible required for purposes of research by Miss DOROTHY B. GEE, Dept. of Zoology and Comparative Anatomy, University Museum, Oxford.

THE
JOURNAL OF CONCHOLOGY

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THE BRACKISH-WATER MOLLUSCA OF BROMBOROUGH POOL, CHESHIRE.

By NORA FISHER MCMILLAN.

(*Read before the Society*, 15 *October* 1949.)

BROMBOROUGH Pool is a sinuous tidal creek carrying the waters of the Dibbin stream and its tributaries to the Cheshire bank of the river Mersey, between New Ferry and Bromborough. Up to the beginning of the twentieth century the tide flowed freely up the inlet for about half a mile beyond the ancient Bromborough Mill, but since then the creek's course has been shortened and about 1911 an embankment was made to carry a railway across the stream just below the mill-dam. Now only a high spring tide (of 30 feet or over) rises over the weir into the dam, and only the mile and a half of creek between the Mersey and the mill-dam is influenced by the tide. It is not, however, regularly tidal, as sluice-gates control the seaward exit past Bromborough Dock, which was opened in April 1931. Price's Candle Works (built 1853–54) are at the mouth of the Pool, the busy New Chester Road crosses the inlet a little further up and above that lie acres of soap-works. In addition, barges plough up and down the inlet at frequent intervals, and thousands of tons of Liverpool's town-refuse obliterated everything on the left bank before 1896. Nevertheless part of the Pool shoreline yet survives in a comparatively unspoilt condition, close to the 17th century Court House. Here the land drops sharply to a patch of salt-marsh filling a little bay (the exact spot may easily be found as two old hulks lie derelict in the middle of the marsh). The main channel of the Pool runs between mud banks and passes the salt-marsh at a lower level, separated from it by a ridge of higher ground, barely awash when the whole marsh is submerged.

The salinity of the Pool waters must fluctuate a good deal, as the Dibbin and its tributaries drain some 25 square miles of mid-Wirral and in wet weather bring down much fresh water. A sample taken 5 July 1943, after much hot dry weather, gave a salinity of 24 promille, while another sample, taken 27 January 1944 when the water-level was very high, showed a salinity of only 9·79 promille.

The vegetation of the marsh can be divided into four zones :—

IV. *Cochlearia anglica* L., *Artemisia maritima* L., *Festuca ovina* L.
III. *Festuca ovina* L., *Aster Tripolium* L., with the alga *Vaucheria.*
II. *Carex* sp. with *Vaucheria* " carpet ".
I. *Vaucheria.*

JAN 5 - 1950

Triglochin maritimum L. occurs sparingly in zones III and IV. Two species of *Vaucheria* are present (*fide* Dr. H. Blackler) but do not fruit and hence are not specifically determinable. They form a close velvety carpet on the mud and cover a large part of the marsh. *Lyngbya* occurs mixed with the *Vaucheria.*

In 1943 the molluscan fauna comprised the two opisthobranchs *Limapontia depressa* Alder and Hancock with its var. *pellucida* Kevan and *Alderia modesta* (Lovén), and the pulmonate *Phytia myosotis* (Draparnaud). No Crustacea were noted except *Orchestia gammarella* (Pallas), and the only other animals observed were small white worms abundant in the *Vaucheria.*

Limapontia depressa. Both the dark type-form and var. *pellucida* were abundant in May 1943, but had disappeared by July. In May 1944 they again appeared, but had gone by July. Attempts to find examples in the autumn and winter months have been unsuccessful. In 1943 and 1944 the molluscs occurred abundantly on *Vaucheria* in zones II and III, with stray specimens in zone I. There is only one pool on the marsh but this, though containing plenty of healthy *Vaucheria*, has never held any *Limapontia* in my experience. *Limapontia* occurred only on the surface of the marsh, taking shelter in very hot weather under plants.

In captivity *L. depressa* always crawled out of the water when possible ; some specimens collected 9 May 1943 were placed in a glass dish with *Vaucheria*, part of which rose above the water-level, and within a few hours all the molluscs had gathered on the projecting part. Further examples, collected 27 May 1944, lived in captivity until 27 July on *Vaucheria* kept moist with brackish water from Bromborough Pool, and it was noticeable that they kept exclusively to the *Vaucheria* above the water-level (there was a little water in the dish to keep the alga moist). Spawn taken in the field was always found on the surface of the marsh, on *Vaucheria*, and that deposited in captivity was laid on the *Vaucheria* above water-level. Animals both of the type-form and var. *pellucida* behaved similarly, thus supporting D. K. McE. Kevan's suggestion (1941) that the variety is " probably not a distinct species, though differing in many respects from the Type ".

During May 1943 seven spawn-masses were kept under observation, but although development proceeded up to the stage of the veligers revolving vigorously and pigmentation well shown none of the veligers was freed. The period of development varied rather widely ; " wild " spawn took 3½ to 4 days to attain the stage just described, while spawn laid in captivity (only one lot studied) took 6 days. None of the veligers reached the stage of shell-formation ; in one case some of the veligers after having been active for 48 hours developed a patch of dark pigment. The cilia were short and widely spaced.

In my experience the two species of *Limapontia* are easily distinguished in the field ; *L. depressa* is much flatter and broader than *L. capitata*, with hardly any tail, and the greatest width behind the middle of the back. The habitats of the two species are usually quite different and I have not found them living together, although D. K. Kevan (1934) did.

Alderia modesta. Only found once at Bromborough Pool—four adult specimens on *Vaucheria* with *Limapontia depressa*, 9–14 May 1943. They were normally coloured and each measured ca. 10 mm. long when extended. In captivity the animals were very restless, continually twisting the body and moving about. Spawn was laid on 14 May and 48 hours later the ova were much swollen; 2 days later (i.e. on 18 May) a veliger was revolving gently. The cilia were noticeably long. On 20 May the veliger was much larger and filled the envelope, a large dark organ had developed and there was a clear space at the base of the veliger. By this time the cilia had stopped moving. No further development took place.

Phytia myosotis. Occurs abundantly in zones II, III and IV during most of the year, but in mid-winter appears to migrate to the higher level of zone IV and none could be found in zones II and III at this time, save a very few small specimens in zone III on 27 January 1944.

Phytia was recorded from Bromborough Pool by Byerley (1856), but thought to be long extinct there. The specimens are rather small, the largest of a score collected at random measured only 6 mm. in height, and most were 4–5 mm.

Byerley also recorded *Hydrobia ulvae* (Pennant) (*sub Rissoa ulvae*) as occurring "in brackish water, of good size, in Bromborough Pool", but it seems to have quite deserted the creek now. A single dead shell was found on the highest salt-marsh (that nearest to the mill-dam) 13 March 1949, but may have been a stray from further afield.

Salt-marsh occurs at intervals along Bromborough Pool as far as the embankment just below the mill-dam, a total distance of about a mile and a half from the Mersey, but the only mollusc that penetrates beyond the salt-marsh at the Court House is *Phytia*. It lives sparingly on the narrow strip of salt-marsh between the sandstone cliff and the creek a little above the bridge carrying the New Chester Road over Bromborough Pool, but is absent further up.

Bromborough Mill dam used to be tidal but now, as already mentioned, only a 30 ft. tide or more rises over the weir into the dam. The dam is silting up rapidly, and is already half covered with *Scirpus maritimus* L. It is floored with deep black mud and contains no molluscs. The old mill-race, though very foul, yielded in 1942 fine examples of *Hydrobia jenkinsi* (Smith) up to 5 mm. in height. All the shells were of the smooth non-carinate form. A very few *Lymnaea palustris* (Müller) and *L. truncatula* (Müller) were also present. The race has now (April 1949) been filled in.

Above the mill-dam there is no salt-marsh but there is a large bed of *Scirpus maritimus* and two of *Phragmites*. None has yielded any molluscs, but *H. jenkinsi* lives sparingly in the stream. The shells are rather small and plump, many of them carinated (var. *carinata* Marshall) and some spined (var. *aculeata* Overton), strikingly different from those of the mill-race. *H. jenkinsi* arrived in the Dibbin in 1948 and has not yet colonized any of the tributary streams, nor extended more than a few yards beyond Otter Bridge, ¾ mile above the mill-dam. Near Otter Bridge *Lymnaea peregra* (Müller) occurs rarely with *H. jenkinsi.*

Bromborough Pool is the only Mersey "pool" or tidal creek still surviving in anything like its original condition. The disappearance of *Hydrobia ulvae* and the absence of such species as *Scrobicularia plana* (da Costa) and *Macoma balthica* (L.) is perhaps due to the polluted waters. Now (April 1949) the opisthobranchiate molluscs seem to have deserted the salt-marsh where they were so plentiful in 1943 and 1944. The marsh itself does not appear to have changed. Kevan (1939) has suggested that the early stages of both *Alderia* and *Limapontia depressa* are passed below L.W.M. and in Bromborough Pool conditions below L.W.M. are so unfavourable (polluted water, disturbance by barges, much silt in suspension, no visible alga-flora) that survival seems unlikely.

To Engel's map (1940) of the European distribution of *Alderia* and *Limapontia* the following localities can now be added :—

Alderia modesta (Lovén). Bromborough Pool ; Cheshire shore of the Mersey estuary.

Limapontia depressa Alder & Hancock. As *Alderia* ; also Flintshire side of the Dee estuary (McMillan 1946).

Limapontia capitata (Müller). Hilbre, Cheshire (McMillan 1942).

REFERENCES.

BYERLEY, I., 1856. *The Fauna of Liverpool.*

ENGEL, H., GEERTS, S. J., and ALTENA, C. O. VAN REGTEREN, 1940. *Alderia modesta* (Lovén) and *Limapontia depressa* Alder & Hancock in the brackish waters of the Dutch coast. *Basteria* **5**, 6–34.

KEVAN, D. K., 1934. *Limapontia depressa* (A. & H.) var. nov. in Scotland. *J. Conchol.* **20**, 16–24.

—— 1939. Further Notes on *Limapontia depressa* (A. & H.) var. *pellucida* Kevan. *J. Conchol.* **21**, 160–162.

KEVAN, D. K. McE., 1941. Notes on *Limapontia depressa* (A. & H.) var. *pellucida* Kevan kept under artificial conditions. *J. Conchol.* **21**, 301–302.

McMILLAN, N. F., 1942. The Marine Mollusca of Hilbre, Cheshire. *Proc. Liverpool Nat. Field Club* for 1941, 15–20.

—— 1946. *Limapontia depressa* Alder & Hancock in North Wales. *J. Conchol.* **22**, 220.

DIVARICELLA DIVARICATA (L.) IN SCILLY.

By T. G. W. FOWLER.

(Read before the Society, 21 May 1949.)

Divaricella divaricata has been recorded but rarely from British waters ; indeed, in Winckworth's List (*J. Conchol.* **19**, 242) it is marked as a species requiring confirmation, since such records as there are are all of single valves. Montagu obtained a valve at Falmouth, Turton records it from Teignmouth, and Jeffreys dredged two odd valves off St. Mawes (*British Conchology* **2**, 236). Marshall (*J. Conchol.* **8**, 352, **14**, 186) records valves from Scilly and Land's End. I am now able to add this species definitely to the British list, as on 12 April 1949 I obtained a living specimen north of Pentle Bay, Tresco, Scilly Isles, in gravelly sand on the foreshore.

THE DISTRIBUTION OF *PILA SPECIOSA* (PHILIPPI).

By T. Pain.

(*Read before the Society*, 21 *May* 1949.)

Considerable misunderstanding seems to have arisen in the past concerning the distribution of the species described by Philippi (1849, 18) as *Ampullaria speciosa*, with the locality Cape Guardafui, which presumably refers to the cape of that name at the extreme northern end of Italian Somaliland. Germain's unfortunate statement (1911, 42) that it occurred in Zanzibar as well as many other localities from Sudan to the Congo seems to have been mainly responsible for the subsequent confusion regarding this species. Alderson (1925, 90, 97), the most recent author on African *Pila* to deal in detail with this species, having given consideration to the statements on its distribution by Germain, Von Martens, Bourguignat and others, concludes that it is now known to inhabit practically the whole of eastern tropical Africa ; he then cites the localities given by Germain.

When Mozley carried out his exhaustive investigations on the freshwater Mollusca in Zanzibar and Tanganyika in 1938 it became evident that only one species of *Pila*, *P. adusta* (Reeve), occurred in Zanzibar, and *P. speciosa* was not found on the adjacent mainland. Unfortunately, Mozley's specimens were identified as *P. gradata* (Smith) and published in his report (1939, 700) as such.

All the specimens of *P. speciosa* which I have so far examined in public and private collections (and it occurs in most collections of African *Pila*) have the locality " Zanzibar ", and it was not until the late Major Connolly received specimens collected in Somaliland by Captain Hunter in 1925 that any reliable evidence as to its true locality was obtained. Since *P. speciosa* is so common in collections it must be fairly numerous where it occurs and easily procurable. Of the localities cited by Germain for this species only Cape Guardafui is correct. Billotte (1885, 111) also records exceptionally large examples brought from Somaliland by Revoil, and a magnificent specimen taken in this territory by Captain Hunter was obtained at Deshek Wama.

Pilsbry and Bequaert (1927, 176) consider the occurrence of *P. speciosa* in the Congo drainage area extremely doubtful. The shells referred to by Germain as having been taken there by Foureau are almost certainly *P. wernei leopoldvillensis* (Putz), whilst the references to various localities in Sudan, Uganda, Tanganyika, etc., refer to *P. wernei* (Philippi), which has long been known to inhabit these areas and has been reliably recorded from a great many localities. Alderson's statement about the range of *P. speciosa* would be correct if applied to *P. wernei*. The true range of *P. speciosa* is restricted to that part of the east African coastal belt stretching from Cape Guardafui in the north to the border of Kenya in the south, and westwards from the Indian Ocean to the Abyssinian Highlands, a region from which *Pila* is unknown.

P. speciosa is usually remarkably constant in form and subject to less variation than most species of the genus, particularly in respect of the beautifully preserved spire and apex, which are usually eroded in other large African species. On account of its detached distribution *P. speciosa* seems to have evolved in complete isolation from other African forms, cut off by the temperate highland region of Abyssinia to the west and by semi-desert country beyond the Juba River to the south along the Kenya border. The area shown on a 1939 map as Italian Somaliland approximates to the true distribution of this species as indicated by the available material obtained by reliable collectors.

Alderson dealt at length with the resemblance between *P. speciosa* and *P. wernei* but reached the conclusion that they should be regarded as separate species. Von Martens (1897, 153) likewise noted the similarity between them, and Germain predicted that they would have to be united so soon as adequate material for comparison became available. After careful examination of considerable series of both species, I have come to the conclusion that there is at present insufficient evidence for considering them as mere forms of the same species. As noted by Alderson, *P. speciosa* has certain peculiarities of its own, small and subtle, but apparently constant. The spire is generally higher, its component whorls being deeper, but the best distinction is found at the suture, where they are flattened but not channelled. This difference will be obvious to anyone who compares specimens of each species and notes the upper insertion of the lip. Finally, the umbilicus is narrower in *P. wernei* and more oblique, in consequence of the greater downward slope of the body-whorl.

REFERENCES.

ALDERSON, E. G., 1925. *Studies in Ampullaria.*

BILLOTTE, R., 1885. Recensement des Ampullaires du Continent Africain. *Bull. Soc. Malac. France* **2**, 103–112.

GERMAIN, L., 1907. *Les Mollusques terrestres et fluviatiles de l'Afrique Centrale Française* (524, 531).

—— 1911. Étude sur les Mollusques terrestres et fluviatiles recueillis au cours de la Mission de délimitation du Niger-Tchad. *Documents scientifiques de la Mission Tilho* **2**.

MARTENS, E. VON, 1897. Beschalte Weichthiere Ost-Afrikas. *Deutsch-Ost-Afrika* **4**, 1–308, pl. 1–7.

MOZLEY, A., 1939. The Fresh-water Mollusca of the Tanganyika Territory and Zanzibar Protectorate. *Trans. Roy. Soc. Edin.* **59**, 687–744, pl. 1–3.

PHILIPPI, R.A., 1849. Centuria tertia Testaceorum novorum. *Zs. Malakozool.* **6**, 17–26.

—— 1851. Die Gattung *Ampullaria*. *Conch. Cab.* **1**, pt. 20 (pl. 11, fig. 2).

PILSBRY, H. A., and BEQUAERT, J., 1927. The Aquatic Mollusks of the Belgian Congo. *Bull. Amer. Mus. Nat. Hist.* **53**, 69–602, pl. 10–77.

REEVE, L. A., 1856. Monograph of the genus *Ampullaria*. *Conch. Icon.* **10**, pl. 1–28 (figs. 33 and 79).

LARGE *CEPAEA NEMORALIS* IN THE LOCARD COLLECTION.

By A. Comfort.

Through the courtesy of Prof. Fischer, director of the Malacological Laboratory, I was able to examine some specimens of *Cepaea nemoralis* L. in Locard's collection, at the Musée d'Histoire Naturelle in Paris. Among a large range of more typical forms, this collection includes three specimens which closely resemble the large western Irish forms described by Welch and Stelfox (1904). One of these is probably the largest example so far described of the "Annacoona" form, while the others closely resemble var. *ponderosa* Malm from Dog's Bay.

1. Locality "Tour de Carat, Pyrénées". Shell yellow, bandless, rather heavily sculptured, peristome white and directed slightly downward, umbilicus almost closed; the apex shows a large unsculptured area of protoconch. Height 2·25 cm., width 3 cm.

This specimen is almost identical in appearance with shells taken at Annacoona, but considerably larger and proportionately thicker.

2. Locality "Environs de Lyon". Yellow, banded, with white lip. Very tall in proportion. Height and width 2·75 cm.
3. Locality "Le Mont Dore" (Auvergne). An immature and slightly damaged shell, the peristome being repaired. Very thick—the texture being similar to that of the Dog's Bay fossils. Height and width 2·5 cm.

The importance of these shells is considerable, since the heavy forms of *C. nemoralis* are known in the living state chiefly from Ireland and there do not appear to be any records of their existence in France. The locality of the first specimen could not be traced by the Museum authorities, but if the Tour de Carat of the label is, as they suggest, a miswriting of Tour de Carol, the form should occur at about 1,100 metres in the Pyrénées Orientales. The Lyon and Auvergne specimens are closer to fossil examples of *C. tonnensis* Sandberger from Central Europe, kindly sent me by Dr. R. Schlickum, than any of the Irish races. In view of Locard's material, it seems likely that a further search around the southern periphery of the range of *C. nemoralis* might reveal a number of colonies of these atypical forms. Locard himself, although he identified the specimens as *C. nemoralis*, does not appear to have commented on their unusual character—specimen 1, if unlocalized, might very easily have been referred to some other species or even genus on its size and form alone. It is to be hoped that French workers who have the opportunity to follow up these specimens will do so.

References.

Comfort, A., 1944. *Cepaea nemoralis* L. in the Dartry Mountains. *J. Conchol.* **22**, 80–82.

—— 1945. *Cepaea nemoralis* L.—Two local forms. *J. Conchol.* **22**, 169–170.

Stelfox, A. W., 1911. A List of the Land and Freshwater Mollusks of Ireland. *Proc. Roy. Irish Acad.* **29** B, no. 3, 65–164.

—— 1945. A large race of *Cepaea nemoralis* L. (and other Mollusca) at high altitudes in the Galtee Mountains, Co. Tipperary South. *J. Conchol.* **22**, 168.

—— 1945. *Cepaea nemoralis* L. in the Dartry Mountains. *J. Conchol.* **22**, 170.

Welch, R. J., and Stelfox, A. W., 1904. Land and Freshwater Mollusca of Sligo and Leitrim. *Irish Nat.* **13**, 183–193.

A GIANT WHELK

By Piet Kaas

[Plate III]

(*Read before the Society,* 15 *October* 1949.)

On 5 May 1949 the captain of the motor trawler *Orion*, of Scheveningen, Holland, on his return from the fishing grounds in the North Sea, handed to me together with other Mollusca a remarkable specimen of the common whelk (*Buccinum undatum* L.) which had been taken at about Lat. 56° 30′ N., Long. 5° E. in a depth of 50–60 metres. Though the captain, Mr. D. Toet, attempted to keep the animal alive in a herring tub partly filled with seawater, it died during the fortnight's journey. The specimen measures 161 mm. from its broken apex to the extremity of the columella and 76 mm. in breadth. It is an exceptionally large specimen of var. *pelagica* King.

King's type specimen measured 93 × 50 mm. Jeffreys (1867, 286) does not give exact measurements but states that var. *pelagica* is " twice the usual size ". Marshall (1911, 199) mentions the smaller and proportionally narrower last whorl of var. *pelagica*, adding that his largest examples exceed 6 inches. An example 6½ inches (166 mm.) in height from the Leckenby collection is recorded by Winckworth (1927). Dautzenberg and Fischer in their description of variation in *B. undatum* (1912, 101–115) describe a shell of 118 × 71 mm. as var. *maxima*, but this was a large example of the typical form, not of var. *pelagica*.

References.

Dautzenberg, P., and Fischer, H., 1912. Mollusques provenant des . . . mers du Nord. *Rés. Camp. Sci. Monaco* **37**.

Jeffreys, J. G., 1867. *British Conchology* **4**.

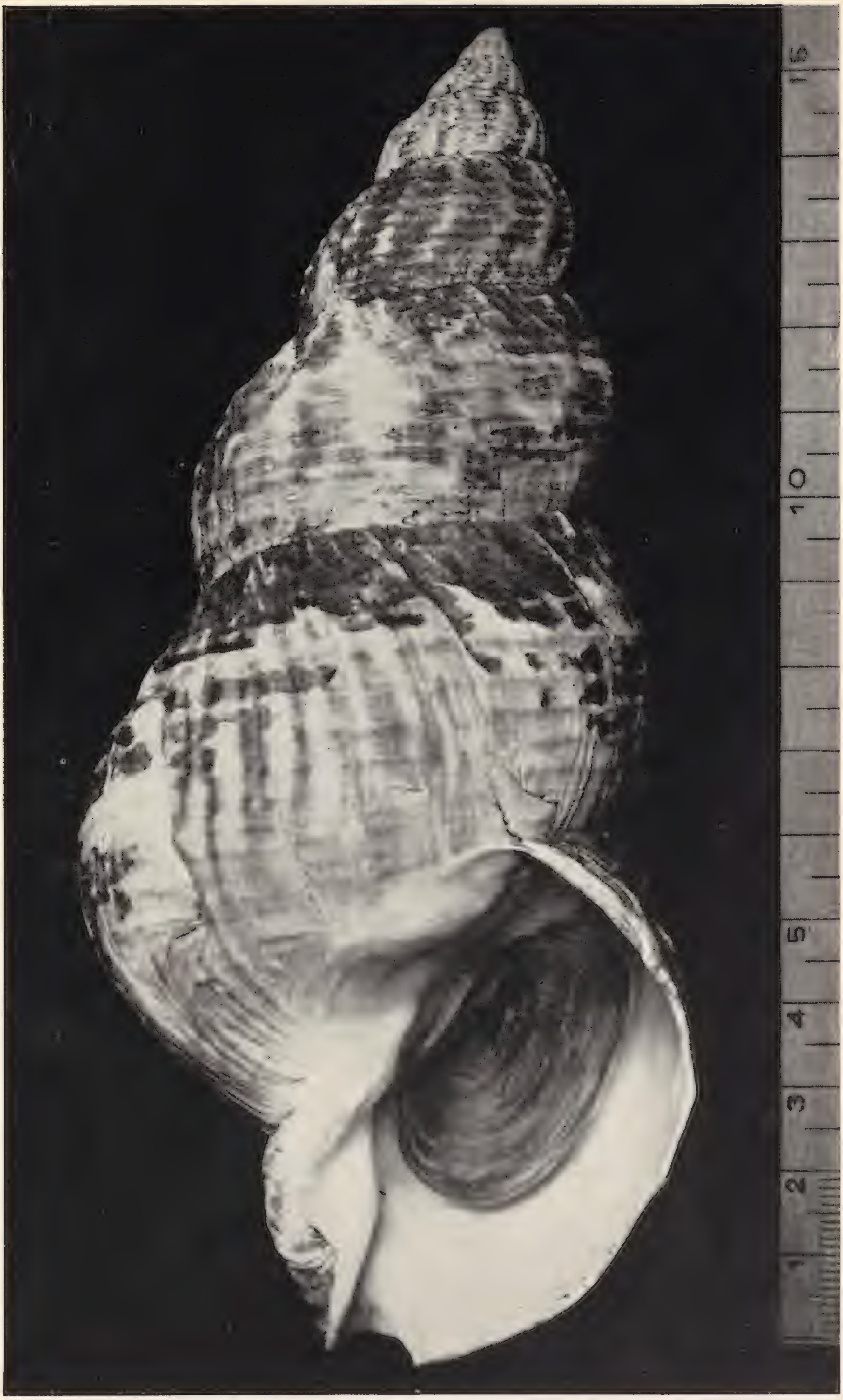
Marshall, J. T., 1911. Additions to " British Conchology ", part 7. *J. Conchol.* **13**.

Winckworth, R., 1927. *Proc. Malac. Soc.* **17**, 177.

A new locality for *Ena montana* (Draparnaud).—On 16 June 1949 my friend, Dr. B. M. Hobby, while sweeping for Diptera, took a nearly full-grown specimen of *Ena montana* by a hedge on the south side of Ditchley Park, near Charlbury, Oxfordshire. This is not a new county record but is of interest, since the locality lies more or less halfway between the well-known localities for this species on the Chilterns and the Cotswolds, each about thirty miles away. The habitat is probably an ancient one, as there is much old woodland there with beeches and other trees, and for *E. montana*, as I previously found near Bruton, Somerset, old hedges may be reckoned as the woods from which they survive (see Boycott, *J. Ecol.* **22**, 1934, 27).

L. W. Grensted.

(*Read before the Society,* 15 *October* 1949.)



Buccinum undatum L. var. *pelagica* King.

[*To face p.* 72.

THE MOLLUSCA OF THE LEEDS NATURALISTS' CLUB AND SCIENTIFIC ASSOCIATION'S AREA.

By W. THURGOOD.

(*Read before the Society, 18 December 1948.*)

MY Presidential address (1941) to the above Club was concerned with the distribution of the Mollusca in the area and it has been suggested to me that the subject is of sufficient interest to warrant a permanent record in the pages of this *Journal.*

The area is of irregular lozenge shape, about 35 miles long and 15 miles wide at its greatest—tapering to a blunt point around the source of the River Wharfe.

A line drawn longitudinally through the centre of the area runs almost exactly N.W. from Castleford to a point on Oughtershaw Side just short of Dodd Fell. The area is divided into fourteen sub-areas.

The surface soil includes, and is mainly composed of, magnesian limestone, coal measures, millstone grit and Yoredale limestone.

In analysing the records, I have been indebted to Dr. H. C. Versey of Leeds University for the loan of geological maps and other help: in the matter of the likes and dislikes of the Mollusca I owe much to Boycott's papers (1934, 1936).

The following are the principal ecological divisions of the Mollusca :—

LAND.

HYGROPHILES or those which prefer wet places (FACULTATIVE HYGROPHILES *may* inhabit wet places).

XEROPHILES or those which prefer dry places (FACULTATIVE XEROPHILES *may* inhabit dry places).

ANTHROPOPHILES frequent the neighbourhood of human settlements (FACULTATIVE ANTHROPOPHILES *may* do the same).

ANTHROPOPHOBES or those not found in the neighbourhood of human settlements.

WOODLAND or those found in "woodland" type of country, not necessarily woods. (FACULTATIVE WOODLAND *may* be found in "woodland" country.)

CALCICOLE which *must* have a lime content in the soil.

CALCIPHILE which prefer lime.

Those which seem indifferent to lime.

Those which frequent stone walls.

FRESHWATER.

Those which prefer soft water.

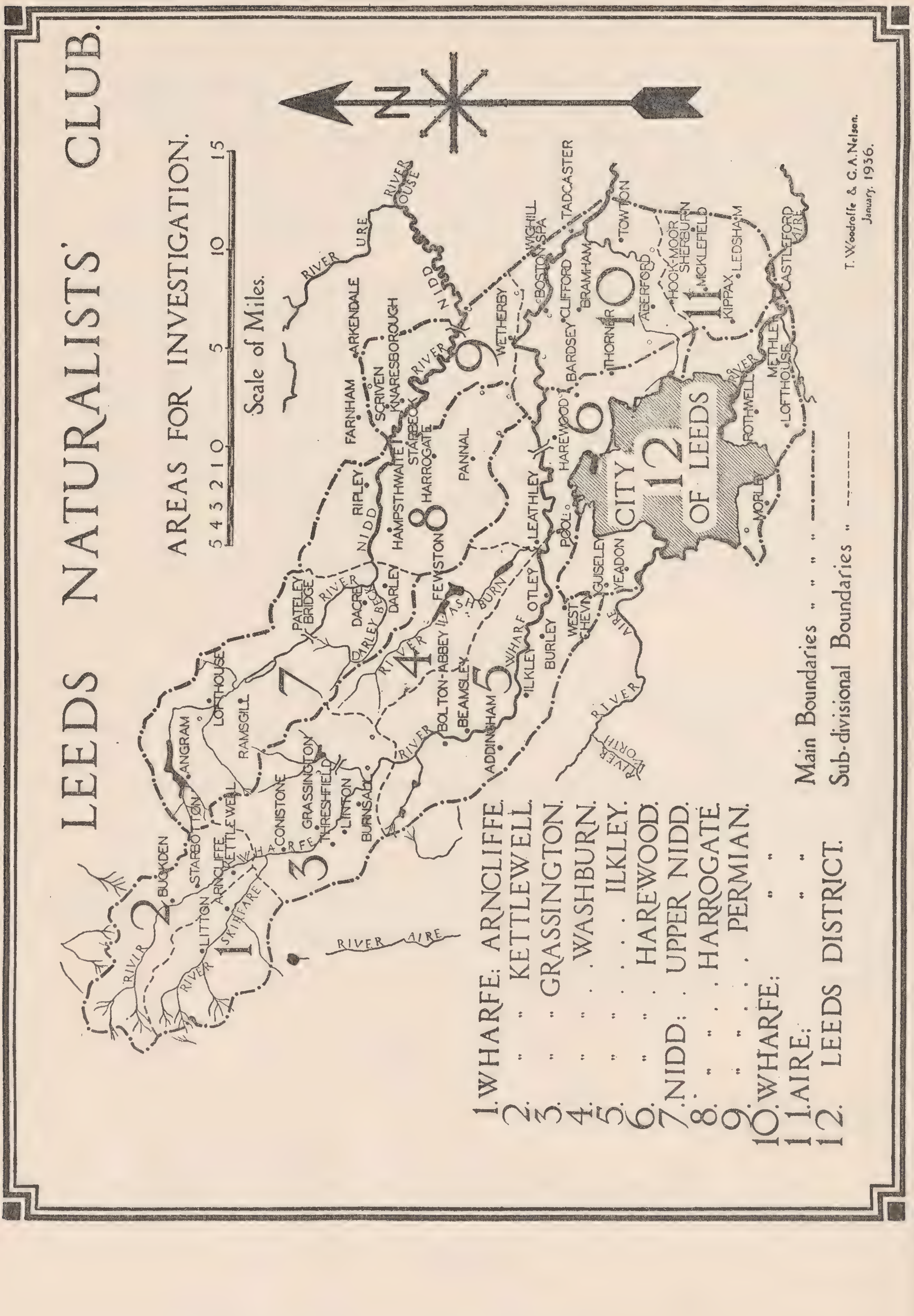
Those which prefer hard water.

To assist in a proper appreciation of this analysis, I give here three extracts from Boycott :—

LAND.

WOODLAND.

Woods as such have no characteristic fauna. What they show in the way of Mollusca depends in the main on their age, the soil in which they are growing and on the degree of shelter (always fairly well provided) and conservation of


LEEDS NATURALISTS' CLUB.
AREAS FOR INVESTIGATION.
5 4 3 2 1 0 5 10 15
Scale of Miles.
N
1. WHARFE: ARNCLIFFE.
2. " " KETTLEWELL.
3. " " GRASSINGTON.
4. " " WASHBURN.
5. " " ILKLEY.
6. " " HAREWOOD.
7. NIDD: UPPER NIDD.
8. " " HARROGATE.
9. " " PERMIAN.
10. WHARFE:
11. AIRE:
12. LEEDS DISTRICT.
Main Boundaries
Sub-divisional Boundaries
CITY OF LEEDS
RIVER URE
RIVER OUSE
RIVER NIDD
RIVER WHARFE
RIVER AIRE
RIVER SKIRFARE
NORTH RIVER
WASHBURN
DARLEY BECK
BUCKDEN
STARBOTTON
ARNCLIFFE
KETTLEWELL
LITTON
ANGRAM
LOFTHOUSE
RAMSGILL
CONISTONE
GRASSINGTON
THRESHFIELD
LINTON
BURNSALL
PATELEY BRIDGE
DACRE
DARLEY
FEWSTON
BOLTON-ABBEY
BEAMSLEY
ADDINGHAM
ILKLEY
BURLEY
OTLEY
WEST CHEVIN
GUISELEY
YEADON
POOL
LEATHLEY
RIPLEY
HAMPSTHWAITE
HARROGATE
STARBECK
PANNAL
FARNHAM
SCRIVEN
KNARESBOROUGH
ARKENDALE
WETHERBY
HAREWOOD
BARDSEY
CLIFFORD
BOSTON SPA
WIGHILL
TADCASTER
BRAMHAM
THORNER
ABERFORD
TOWTON
HOOK-MOOR
SHERBURN
MICKLEFIELD
KIPPAX
LEDSHAM
CASTLEFORD
METHLEY
LOFTHOUSE
ROTHWELL
MORLEY
T. Woodroffe & G. A. Nelson.
January, 1936.

moisture. . . . " Woods " is evidently not a significant category for the Mollusca. Old self-planted hedges of mixed trees and bushes obviously go with them, and also scrubs and near-scrubs and undercliffs of various kinds ; these represent ancient and relatively undisturbed natural habitats. The verbal difficulty arises when it appears that we should include also the nooks and ravines on bare sea-cliffs. Rather unfortunately the term " woodland " has been applied to this collection of habitats which without any great external similarity evidently have a common element in their relation to Mollusca. With " woodland " there is also an implication of " wild " so that in effect the word has come to mean almost any unsophisticated place other than a marsh, a bare grass down, a heath or a moor, practically excluding modern plantations. The nomenclature is unsatisfactory, but the conception seems to represent the fact that there is a series of habitats which " woodland " species frequent, shelter, moisture, and stability being the germane factors (Boycott, 1934, 25, 27).

GENERAL SUMMARY.

Our land Mollusca do not form specific associations with one another or with other animals or plants. Competition is therefore an unimportant factor. Their occurrence within their geographical ranges are determined by the conditions of the environment, the most important factors being moisture and lime. We may distinguish groups which affect wet places, dry places and human settlements. The rest, about half the species, live in ill-defined " woodland " habitats whose suitability varies in proportion to the shelter and lime they provide. In the alternative classification, we have one calcifuge species, about twenty calcicoles, about eighteen which prefer lime and some forty-five which are indifferent (Boycott, 1934, 34).

FRESHWATER.

SUMMARY AND CONCLUSIONS.

Water Mollusca are not dependent on other animals except that *Anodonta* and *Unio* have an obligatory parasitic phase on fish. Nor have they any specific foods. There are indications that the habitats of a few species are partly determined by competition with other Mollusca, but in general this is unimportant and most of the species which occur in the worst places are found also in the best. Hence each species can live in any place where its characteristic needs are met by the physical and chemical conditions. The more important features of favourable habitats are (1) cleanliness of water, (2) absence of disturbance, and (3) presence of lime : other factors such as rate of flow, volume of locus, vegetation, etc., are of moment because of their influence on the first two. Bivalves, operculates, and pulmonates can each be divided into a group which can live in soft as well as hard water and one which ordinarily needs a fair amount of lime : also into those which can tolerate stagnant water (which include no operculates) and those which need clean and usually running water. With a few exceptions, the needs of the species are so similar that habitats can be classed as good or bad for Mollusca as a whole : the richest places are calcareous rivers, lakes and canals ; the poorest rapid streams, mean ponds and mountain lakes (Boycott, 1936, 178).

Since I made my first analysis for the purpose of my Presidential address to the Leeds Naturalists' Club, I have had the opportunity of examining and entering some hundreds of records compiled by W. Denison Roebuck, together with a good many culled from early volumes of *The Naturalist*, and the present amended and extended analysis embodies conclusions drawn from the 2,404 records entered to date (30 September 1945).

I will deal with each sub-area separately.

LEEDS CITY is acid. Sixty species are recorded : thirty-one land and twenty-nine freshwater. Of the land species eleven are hygrophiles and six xerophiles. As might be expected, seventeen are definite or facultative anthropophiles; twenty-one are woodland and recorded for the various woods and parks. Four frequent stone walls. There are two calcicoles and eight calciphiles. One of the latter is *Helix nemoralis* Linné, recorded from Lawnswood and a large range sent to me by Dr. Lloyd from his garden in Lidgett Lane, Moortown. The remainder are those indifferent to lime—the only calcifuge, *Zonitoides excavatus* (Alder) is recorded.

Of the twenty-nine freshwater species, fourteen prefer soft and fifteen hard water. There are some curious results. From the canal at Kirkstall we get three soft and six hard water species. In King Lane, where the water consists of ponds with no commercial usage, we get four soft and five hard water species. Weetwood gives two soft water: Gledhow two soft and one hard water: Osmondthorpe three soft and two hard water: Meanwood three soft and one hard water.

LEEDS DISTRICT SOUTH is acid. Forty-nine species are recorded: twenty-four land and twenty-five freshwater. Of the land species, there are four times as many hygrophiles as xerophiles: eleven are definite or facultative anthropophiles, whilst twenty-one are woodland. In the matter of lime, two frequent stone walls; three are calcicoles; seven prefer lime and fourteen are indifferent to lime. The only calcifuge is recorded. The calcicoles and those which prefer lime are from Rothwell and Garforth, in both of which neighbourhoods a certain amount of lime may have been due to building operations in the past.

Of the twenty-five freshwater species, eleven prefer soft and fourteen hard water. With the exception of *Pisidium personatum* Malm from Garforth, all come from the same places: Methley, Castleford, Rothwell and Woodlesford. I shall have something to say about this later on.

LEEDS DISTRICT NORTH is acid. Fifty-six species are recorded: thirty-six land and twenty freshwater. Of the land species, thirteen are hygrophiles and seven xerophiles; eighteen are definite or facultative anthropophiles; twenty-six are woodland species. As to lime, five species frequent stone walls, four are calcicoles, thirteen prefer lime and nineteen are indifferent to lime. The majority of the records for the calcicoles and calciphiles are for Roundhay Lime Hills, the records going back for eighty years. Three calcicoles are recorded fairly recently at Cross Gates, Lawnswood, Adel, Alwoodley and Creskeld Lane, Bramhope. It seems likely that two of these, *Helicella virgata* (da Costa) at Cross Gates and *Helicella caperata* (Montagu) at Lawnswood and King's Road, Adel, have got their lime through building operations. *Hygromia striolata* (C. Pfeiffer) is also recorded at Adel, King Lane, Alwoodley and Creskeld Lane, Bramhope. Of the development of the specimens, with two exceptions, I am unable to speak, as the records were made anything up to fifteen years ago. The two exceptions (*Helicella caperata* at King's Road, Adel, and *Hygromia striolata* at King Lane, Alwoodley) are records made by Mrs. Thurgood and myself: the shells are definitely of comparatively poor development, due no doubt to shortage of lime. The only calcifuge is recorded.

Of the twenty freshwater species, eleven are soft and nine hard water species. One record made by Mrs. Thurgood and myself seems to run counter to Boycott. We took the hard water *Bythinia tentaculata* (Linné) from a soft water pond in Moseley Wood, Horsforth, and the specimens were of good average size and shell development.

PERMIAN AIRE is calcareous. Forty-eight species are recorded: thirty-one land and seventeen freshwater. Of the land species, the hygrophiles number sixteen and the xerophiles ten. Thirteen are definite or facultative anthropophiles and twenty woodland. The records show six stone wall species; seven calcicoles; ten calciphiles; fifteen indifferent to lime.

Of the sixteen freshwater species, ten prefer soft and six hard water. Some of the results are curious and confirm what I say later about the line of demarcation between soft water and hard water species. The more recent records are for Fairburn Ings and the older records are for Fairburn Ings and the Sherburn and Milford districts. Of the hard water species the recent records are mainly for Fairburn and Ledston, whilst the older records cover Fairburn and the Sherburn, Milford, and Church Fenton areas. For the soft water species there are more records for the three areas just named than for the Fairburn district. Of recent soft water species, *Planorbis leucostoma* Millet was taken by Mrs. Thurgood and myself in a field ditch near Ledston railway station—the water certainly was soft. Another soft water species, *Lymnæa palustris* (Müller), was taken in Fairburn Ings and was of large size and good development. All the Fairburn Ings specimens we have taken have been of good size and shell content, which seems to point to the Ings having a fairly large lime content.

PERMIAN WHARFE is calcareous. It holds pride of place with sixty-four species recorded, forty-three land and twenty-one freshwater. This relatively large " bag " is doubtless due to the comparative nearness of the sub-area and to the general attractiveness of the good collecting centres. It would be difficult to find, in a calcareous district such as this, anything that would run counter to Boycott. If, for example, one found the calcifuge *Zonitoides excavatus* even sparsely, one might begin to question.

Of the forty-three land species recorded, fifteen are hygrophiles and ten xerophiles; seventeen are anthropophiles and two anthropophobes; thirty woodland. As to lime, six frequent stone walls; nine are calcicoles and seventeen prefer lime; seventeen seem indifferent to lime. The calcifuge is not recorded. The calcicoles include the only one which requires at least 5 per cent of carbonate in the soil; this is *Pomatias elegans* (Müller), taken at Collingham and Boston Spa. This sub-area has two of the five anthropophobes recorded for the whole area, namely *Hygromia subrufescens* (Miller) and *Acme fusca* (Montagu).

Twenty-one freshwater species are recorded, fourteen soft and seven hard water. There are some curious facts here. The Wharfe at Woodhall Bridge yields one soft and one hard water species, *Lymnæa peregra* (Müller) and *Theodoxus fluviatilis* (Linné) respectively. The *Lymnæa* *peregra* include one immature sinistral specimen taken by Mr. J. C. North of Huddersfield, 11 July 1937. Mrs. Thurgood and I were present and we all searched long and carefully, but could not find another sinistral. A pond near Woodhall Bridge yields soft water species only, as do some shallow ponds in a disused quarry east of Boston Spa. Collingham Beck gives soft water species only, whilst the Wharfe at Collingham yields hard water species only, and at Boston Spa five soft and five hard water species. I imagine the River Wharfe generally is " soft ", that is, with a comparatively small lime content. This does not mean that Boycott is wrong, but that the demarcation line in freshwater species is more elastic than in the case of terrestrials.

PERMIAN NIDD is calcareous. Thirty-one species are recorded—twenty land and eleven freshwater. Of the land species, seven are hygrophiles and six xerophiles ; eight are anthropophiles and one anthropophobe ; there are fifteen woodland species. As to lime, five species frequent stone walls ; six are calcicoles ; eight prefer lime and seven are indifferent to lime.

Of the freshwater species, six are soft and five hard water. All of these (with one exception—*Ancylus fluviatilis* Müller, from the River Nidd near Knaresborough) are recorded for ponds and becks in the sub-area, so that the position in regard to the Nidd is not the same as that of the Wharfe. Two of the hard water species are recorded for ponds at Plumpton.

NIDD HARROGATE is acid. Thirty-eight species are recorded : twenty-four land and fourteen freshwater. Most of the records are very old ones. Up to the entering of the Roebuck records already referred to, only two freshwater species were recorded and those of two soft water species (*Ancylus fluviatilis* and *Lymnæa peregra*) taken in a draining ditch near Harrogate by Mrs. Thurgood and myself.

Of the land species, ten are hygrophile and five xerophile ; ten anthropophile and one anthropophobe ; nineteen are woodland. In regard to lime, two species frequent stone walls ; five are calcicoles ; six prefer lime and twelve are indifferent to lime. The only calcifuge is recorded.

The freshwater species comprise eight soft and six hard water. The majority of the records are for ponds and becks. Of the River Nidd records there is one for the soft water *Margaritifera margaritifera* (Linné) (the only record for this species in the whole of the Club's area) in the Nidd at Ripley and for the hard water *Anodonta cygnea* (Linné) from a stream flowing into the Nidd near Ripley. The stream and mill race at Fullwith give five soft and one hard water, the latter *Pisidium amnicum* (Müller). Rudding Park yields two soft and two hard water species.

NIDD UPPER is acid, with some calcareous ground around Lofthouse. All the records are of old date and consist of twenty land and five freshwater species. Of the land Mollusca, seven are hygrophile and three xerophile ; eight anthropophile and one anthropophobe ; sixteen are woodland. As to lime, two species frequent stone walls ; three are calcicoles ; five prefer lime and ten are indifferent. The only calcifuge is recorded. Taking an area of two miles radius around Lofthouse to represent the calcareous, two of the three calcicoles (*Helicella virgata* and *Azeca goodalli* (Férussac)) are recorded in that circle and one (*Hygromia striolata*) both inside and outside, in fact over most of the sub-area. Of the five which prefer lime, all are recorded inside the circle and two (*Oxychilus cellarius* (Müller) and *Lauria cylindracea* (da Costa)) outside. *Lauria cylindracea* is a stone wall species and will get a certain amount of lime in such a habitat. *Retinella pura* (Alder) is recorded for Pateley, outside the circle. This species does not, I should imagine (like all the *Zonitidæ*) require a large lime content. The only calcifuge (*Zonitoides excavatus*) is recorded for Guisecliff Wood, near Pateley Bridge.

Of the freshwater species, three are soft and two hard water. The curious thing is that all are recorded from either Darley or Darley Beck. Three of the species are *Pisidia* and, even were the specimens available, comparative development would be hard to determine in their case.

WHARFE HAREWOOD is acid. Thirty-five species are recorded ; twenty-eight land and seven freshwater. Of the land species, eleven are hygrophile and four xerophile ; fourteen anthropophile and two anthropophobe ; twenty-five are woodland. In regard to lime, there are two stone wall species ; three calcicoles, eight which prefer lime and seventeen which are indifferent to lime. Curiously, the only calcifuge is not recorded.

Of the three calcicoles *Helicella virgata* is recorded for Cross Gates ; *Helix aspersa* Müller for Harewood ; *Hygromia striolata* for Arthington, Weardley, Netherby and Harewood Park. Of the heavier-shelled Mollusca which prefer lime, we have *Helix nemoralis* recorded for Seacroft and Creskeld Lane, Bramhope, and *Helicigona lapicida* (Linné) taken near Thorner and on the Wetherby road seven miles from Leeds. Of the development of the specimens I cannot speak, except for the *Helix nemoralis* from Creskeld Lane, Bramhope, which Mrs. Thurgood and I took : these were of ordinary size and good development. It will be noted that twenty-five of the species recorded are woodland—this accords with the general character of the sub-area. The fourteen anthropophiles are all recorded for localities with human settlements near, whilst the two anthropophobes are recorded for places away from human settlements.

All the freshwater species (seven) were taken in ponds or becks, so that the question of the River Wharfe does not arise.

WHARFE ILKLEY is acid, with some calcareous localities in the N.W. Thirty-nine species are recorded : thirty-one land and eight freshwater. Of the land species, twelve are hygrophiles and eight xerophiles ; eleven are anthropophiles ; three anthropophobes ; twenty-two woodland. The localities for the last three categories follow what I said under Wharfe Harewood. As to lime, seven species frequent stone walls ; five are calcicoles ; seven prefer lime ; sixteen indifferent. The only calcifuge is recorded. Of the calcicoles and those which prefer lime, practically all the records are for Addingham, Bolton (Abbey and Woods) and Ilkley. Several of the Ilkley records are for " near lime kilns ", others for " side of Ilkley Bridge ".

The eight freshwater species are equally divided between hard and soft water. The soft water species are recorded from the River Wharfe at Ilkley and from streams and ditches at Otley, Ilkley, Middleton and Rombald's Moor ; also from the lake at Denton Park. The hard water species are recorded from the River Wharfe at Ilkley, Otley and Burley, and from the lake at Denton Park. The River Wharfe and the lake at Denton Park harbour both soft and hard water species—I will comment on this later.

WHARFE WASHBURN is acid. Only twelve species are recorded : ten land and two freshwater. Of the land species four are hygrophile and three xerophile ; four anthropophile ; eight woodland. The anthropophiles are recorded for near human settlements, including Fewston Churchyard. The woodland species are recorded mainly for Lindley and Dob Park Woods. As to lime, one is a stone wall species ; one calcicole ; two prefer lime and six are indifferent. The calcicole *Hygromia striolata* is recorded for Fewston Churchyard and Glaston Beck, Lindley Wood. Those which prefer lime are recorded for Fewston Churchyard, side of Swinsty Reservoir and Glaston Beck, Lindley Wood. Those indifferent to lime are six : four of these are recorded for Glaston Beck, Lindley Wood, two for the Old Camp, Fewston, and two for Fewston Churchyard. The stone wall species, *Vallonia pulchella* (Müller), is recorded for Glaston Beck, Lindley Wood only. The calcifuge and woodland *Zonitoides excavatus* was taken in Dob Park Wood.

Of the two freshwater species recorded, the soft water *Ancylus fluviatilis* is recorded for three streams (*a*) into the Washburn above Leathley, (*b*) into Lindley Wood Reservoir, (*c*) in Dob Park Wood. The hard water *Lymnæa auricularia* (Linné) is from Swinsty Reservoir and the Blubberhouses end of Fewston Reservoir.

WHARFE GRASSINGTON is largely calcareous, with some acid in the south-east. Forty-two species are recorded : thirty-five land and seven freshwater. Of the land species fifteen are hygrophiles and eight xerophiles ; eleven are anthropophiles and two anthropophobes, the latter being taken in places away from human settlements. Twenty-four woodland species are recorded. In respect of lime, eight species frequent stone walls, whilst five are calcicoles ; fifteen prefer lime and sixteen are indifferent to lime. The only calcifuge is not recorded, even from the south-east part of the sub-area.

Of the freshwater species, six are soft and one hard water. The records for soft water species range from the River Wharfe at Grassington to ditches by the roadside at Grassington and Linton ; the dams at Drygill and Hebden Mill ; Trollers Gill ; Ghaistrills ; Burnsall.

The only hard water species, *Planorbis vortex* (Linné), is recorded for Grassington.

WHARFE KETTLEWELL is calcareous—acid perhaps on some summits. Twenty-five species are recorded : twenty-three land and two freshwater. Of the land species, seven are hygrophile and six xerophile; ten anthropophiles are recorded from near human settlements and two anthropophobes away from such settlements. Twenty of the species are woodland. As to lime, five species frequent stone walls; three are calcicoles ; eight prefer lime and twelve seem indifferent. The only calcifuge, *Zonitoides excavatus*, is not recorded. As acid surfaces are confined to summits, this is not to be wondered at, as the species is also a woodland one ; woodland conditions are not likely to obtain on summits.

Only two freshwater species are recorded, one soft and one hard water. The species are *Planorbis leucostoma* and *Ancylus fluviatilis* respectively, and both are recorded for a stream below Lord's Wood, Starbotton.

WHARFE ARNCLIFFE is calcareous—acid perhaps on some summits. The total species recorded are only five ; all terrestrial. They include two hygrophiles and two xerophiles ; two anthropophiles (from near human settlements) and two anthropophobes (away from human settlements) ; three woodland species. In regard to lime, stone wall species are two ; no calcicoles are recorded, but three which prefer lime. The records also include two which seem indifferent to lime. The only calcifuge is not recorded—the remarks under the head of Wharfe Kettlewell apply here also.

To sum up the results of the analysis, and bearing in mind what Boycott says about lime, the following seem to call for some remark :—

Hygromia striolata. This is a calcicole, but is so ubiquitous over the whole area, whatever the surface conditions, as to drive one to the conclusion that it can do with the very minimum of carbonate in the soil. I therefore eliminate it from my subsequent comments.

LEEDS CITY is acid. Two calcicoles and eight which prefer lime are recorded. These are all odd records and do not disprove Boycott. There is one very interesting record. *Balea perversa* (Linné), which is indifferent to lime, is recorded as follows by Roebuck :—

> " One on old ivy-covered wall at 259 Hyde Park Road, Leeds. None thrown out by me.—W. D. R."

Roebuck at that time (1909) lived at 259 Hyde Park Road.

LEEDS DISTRICT SOUTH is acid. All the records for calcicoles and those which prefer lime are scattered and again do not disprove Boycott. One curious thing is that practically all the soft and hard water species are recorded for the same places, Castleford, Methley, Rothwell and Woodlesford. I will refer to this point later.

LEEDS DISTRICT NORTH is acid. Here the majority of the calcicoles and those which prefer lime are recorded for Roundhay Lime Hills, which locality must be taken as an exception to the general character of the surface of the sub-area. The only exception to Boycott seems to be the hard water *Bythinia tentaculata* from a soft water pond in Moseley Wood, Horsforth. This record was made by Mrs. Thurgood and myself: the specimens were of good average size and shell development.

PERMIAN AIRE is calcareous. It will be noted that Fairburn Ings harbours both soft and hard water species. The shell development of the soft water species taken by us seems to indicate that the Ings have a fairly good lime content.

PERMIAN WHARFE is calcareous. Here a point worthy of note is that the River Wharfe yields both soft and hard water species. I am unable to comment on shell development.

WHARFE HAREWOOD is acid. The records include three calcicoles and eight which prefer lime. These records are from scattered localities and do not disprove Boycott.

WHARFE ILKLEY is acid. Five calcicoles and nine which prefer lime are recorded. The same remarks apply as in the case of Wharfe Harewood. The freshwater records are equally divided between soft and hard water.

WHARFE WASHBURN is acid. The records for both land and freshwater species are few and inconclusive.

WHARFE KETTLEWELL is calcareous ; acid perhaps on some summits. The only point worth noting is that one soft and one hard water species are recorded for the same stream. This point will be covered later.

GENERAL REMARKS.

Terrestrial Species.

The calcareous sub-areas and the calcareous portions of acid sub-areas yield twice as many calcicoles and species which prefer lime as do the acid sub-areas and the acid portions of calcareous sub-areas. This takes into account Roundhay Lime Hills in LEEDS DISTRICT NORTH. In the calcareous sub-areas and portions not only are there more different species, but the records are much more numerous and widespread.

Freshwater Species.

The whole of the evidence seems to point to the conclusion that the line of demarcation between those which seem indifferent to lime (soft water species) and those which prefer lime (hard water species) is much more elastic in the case of the freshwater than of the terrestrial species. It will generally be found, however, that hard water species taken in soft water will have much less robust shell development than those taken in the preferred hard water.

Both.

On broad lines Boycott's learned and painstaking conclusions are supported by the records of the Leeds Naturalists' Club's area.

It is a matter of real regret to me that I am unable to make an exhaustive study and comparison of the size and shell texture and development of the specimens referred to in these records. This, unfortunately, is impracticable: the great majority of the records are of old date, stretching back up to eighty years or more. I have no knowledge as to the existence of the specimens, much less of their present location.

The subjoined table shows, for each sub-area, the analysis of the records in summary form.

APPENDIX.

Characteristics	LC A	LDS A	LDN A	PA C	PW C	PN C	NH A	NU ACL	WH A	WI ANW	WW A	WG CSE	WK CAS	WA CAS
Land.														
Hygrophiles*	11	12	13	16	16	7	15	11	11	12	4	15	7	2
Xerophiles*	6	3	7	10	10	6	7	3	4	8	3	8	6	2
Anthropophiles*	17	11	18	13	17	8	19	14	14	11	4	13	10	2
Anthropophobes	Nil	Nil	Nil	Nil	2	1	1	1	2	3	Nil	2	2	2
Woodland*	21	21	26	20	31	15	27	22	25	22	8	27	20	3
Stone Walls	4	2	5	6	6	5	4	2	2	7	1	8	5	2
Calcicole	2	3	4	7	9	6	5	3	3	5	1	5	3	Nil
Calciphile	8	7	13	10	17	8	12	9	8	9	2	16	8	3
Indifferent to lime	20	14	19	15	19	7	17	12	17	16	6	18	12	2
Calcifuge	1	1	1	Nil	Nil	Nil	1	1	Nil	1	1	Nil	Nil	Nil
Freshwater.														
Soft water	15	11	12	10	14	6	8	3	7	4	1	6	1	Nil
Hard water	14	14	10	6	7	5	7	2	Nil	4	1	1	1	Nil
Total Species.														
Land	31	24	36	31	44	20	31	22	28	31	13	38	23	5
Freshwater	29	25	22	17	21	11	15	5	7	8	3	7	2	Nil
Both	60	49	58	48	65	31	46	27	35	39	16	45	25	5

* Including facultatives.

A.	acid.
C.	calcareous.
ACL.	acid, some calcareous round Lofthouse.
ANW.	largely acid, some calcareous in north-west.
CSE.	largely calcareous, acid in south-east.
CAS.	calcareous, acid perhaps on some summits.

LC	Leeds City.	NU	Nidd Upper.
LDS	Leeds District South.	WH	Wharfe Harewood.
LDN	Leeds District North.	WI	Wharfe Ilkley.
PA	Permian Aire.	WW	Wharfe Washburn.
PW	Permian Wharfe.	WG	Wharfe Grassington.
PN	Permian Nidd.	WK	Wharfe Kettlewell.
NH	Nidd Harrogate.	WA	Wharfe Arncliffe.

REFERENCES.

BOYCOTT, A. E., 1934. The Habitats of Land Mollusca in Britain. *J. Ecol.* **22**, 1–38.

—— 1936. The Habitats of Fresh-water Mollusca in Britain. *J. Animal Ecol.* **5**, 116–186.

***Acme fusca* (Montagu) near Doncaster.**—While searching for Mollusca, in company with Mr. Roland Taylor and the late Mr. Ernest Stainton, at Leuitt Hagg, south-west of Doncaster, 2 August 1948, I found a living specimen of *Acme fusca*. It was found under rotting wood together with numerous specimens of *Carychium minimum* Müller. The ground consisted of loose earth and small fragments of limestone, with abundant moss.

A. STANLEY COOK.

(*Read before the Society*, 15 *October* 1949.)

***Limapontia depressa* Alder and Hancock in Suffolk and Glamorgan.**—On 5 May 1949 at East Bergholt, Suffolk, var. *pellucida* Kevan (*J. Conchol.* **20**, 1934, 16) of this small nudibranchiate mollusc was found in considerable numbers crawling over the damp mud and Conferva on the sides of empty brackish-water ditches in salt-marshes bordering the River Stour, half a mile below the lock at Flatford Mill. On 24 May the typical form was found on a similar site on the Lloughor estuary, between Gowerton and Penclawdd, about a mile from Penclawdd, near Swansea, Glamorgan. It was recorded here as *L. nigra* Johnston by Spence Bate just a century ago.

H. E. QUICK.

(*Read before the Society*, 15 *October* 1949.)

Further observations on *Charonia lampas* (L.).—*Charonia lampas*, previously recorded (*J. Conchol.* 23, 37) from the lower littoral zone at Socoa, B.-P., has been found there again throughout 1949. It appears to be becoming more numerous : eleven were seen in a few minutes at low tide on 25 September. At least seven were taken during the summer at low spring tide at Guéthary, about seven kilometres from Socoa in a straight line. A living specimen was also found washed up on a small beach between these two places. Monsieur Arné, mentioned in my previous note, lives on the cliff at Guéthary and has had the shore under observation for many years. He had never seen *C. lampas* on the shore at Guéthary, nor heard of its being found there, until this summer. It would seem that, on the Basque coast at any rate, *C. lampas*, hitherto regarded as a denizen of the coralline zone, has recently extended its habitat as far as the lower littoral zone.

B. S. KISCH.

(*Read before the Society*, 19 *November* 1949.)

OBITUARY.

C. H. Moore, 1869–1949.

Charles Herbert Moore was born on 12 April 1869 and died at Stalybridge on 2 February 1949. He collapsed at his home during the previous week and never recovered.

Moore was a life member of the Conchological Society, having joined in 1902. He was deeply interested in many subjects besides conchology, being an ornithologist, entomologist, gardener, photographer, musician, Rugby football and cricket enthusiast, and a great worker for his church. Sparely built and bearded he was well known to many people as a somewhat eccentric man who liked to feed wild birds as well as hunt the canals and countryside for shells. His wife predeceased him by several years. She was a constant companion in his jaunts to the country and especially to the Lake District. In his youth he walked all over the Lake District again and again and never tired of it. Only last summer he went tramping in that area by himself. He gave many lectures illustrated with slides made by himself. He retained his remarkable physical and mental vigour almost to the end of his life.

Our departed member, one of the old Manchester school, was for many years Librarian and Curator of the Society. He made several contributions to the *Journal* relating to some of his discoveries. His first exhibit was in 1903, consisting of *Vertigo alpestris* from Holker, North Lancashire. This was followed by a short paper on the subject. He obtained his first specimens in September 1902, the first record for North Lancashire, and he was very proud of this. In 1904 I collaborated with him in a joint paper on the Mollusca of the Grange-over-Sands district, forty-seven species being recorded, seven being additions to *v.c.* 69. In that year he joined my party on an excursion to Knott End, near Fleetwood, in search of marine Mollusca. In later years he exhibited shells from Grange and Cark, in North Lancashire, and from the canals at Bardsley and Droylsden, near his home. In 1914 he allowed me to go through his large collection of non-marine shells for the purpose of obtaining records for the Lancashire and Cheshire Fauna Committee. The collection contained many species from the canals near his home obtained from 1901 onwards. He was a member of that Committee and auditor for many years: he was also a member of the North-West Naturalist Union.

Before his retirement in 1922 Moore was employed at the Anglo-Syrian Trading Company, Manchester, and in the office of Messrs. Wilson and Roberts of Millbrook, Stalybridge. He was also for a long period one of the most active members of the Stalybridge Harmonic Society, and his love and knowledge of music found expression in the St. Paul's Operatic Society, Stalybridge, of which he was for long its inspiring leader. His service at St. Paul's was great, for he held many appointments such as teacher, librarian, register secretary, school secretary and superintendent over a period of over fifty years. The Young Men's Society had a special place in his life, while he played for his church cricket team for many years. He was interred at St. Paul's, Stayley, following a service in the church conducted by the Vicar, Canon Slater, and the curate. The Vicar paid a last tribute to an esteemed colleague and valued friend. The service was attended by a large concourse of his late wife's relatives and friends.

J. WILFRID JACKSON.

F. TAYLOR, 1871–1949.

THE death of FRED TAYLOR on 2 February removes from our midst one of the most ardent and genial conchologists of the Manchester school. He was born on 31 January 1871 and passed away peacefully at his Oldham home two days after attaining his 78th birthday. He was educated at the Derker Mills School run by the late Mr. Hilton Greaves, and from there went to work at the Derker Mills and later went to Messrs. Asa Lees, textile machinery makers, as an apprentice fitter.

Taylor joined the Society in 1895 but could never be persuaded to take office, though he acted as Recorder from 1907-1911. We often asked him to be nominated as Vice-President, but he always refused.

I first became acquainted with him in 1901 when I joined the Society, and during the succeeding years I learned a great deal from him about local shells. He was always ready to help anyone interested in the subject and was extremely generous with his duplicate material. We had many expeditions together to the local canals and other places in search of shells. His cleaning faculty was unique even with most tiresome and tiny forms. He was adept in finding rare and minute species and on one occasion in the 1890s, when at Douglas, Isle of Man, he called on his shell friends W. Moss and R. Cairns, who were staying at Peel. They hailed him with delight and said " Come with us to Whitestrand Bay as we are sure *Acme lineata* is in the valley, but we cannot find it." In less than ten minutes Taylor found it and it was not long before the others secured specimens.

Taylor's acquaintance with Moss and Cairns came about in a curious way. These two conchologists had discovered a pond near Ashton-under-Lyne containing a large colony of white *Planorbis corneus* and were collecting them and using them for exchange purposes with friends. One day they found Taylor hunting for white *Planorbis* in what they considered an unknown preserve. This led to a mutual friendship with the budding conchologist, a close and intimate friendship which continued for many years. During the last months of Cairn's illness Taylor paid frequent visits and helped to soothe and comfort him at a time when Taylor had suffered the grevious loss of one of his own children.

Taylor was intimate with the old Manchester school of conchologists, C. Oldham, R. Standen, E. Collier, B. R. Lucas and others, and was always welcome at the meetings held at the Manchester Museum. His first exhibit was in 1892 (before he was a member) when he showed shells from new localities at Oldham. In the previous year Levi Tetlow had recorded a number of freshwater species from Park Bridge in the *Journ. Oldham Micro. and Field Club*, and in earlier years R. Cairns had recorded shells from the canals at Bardsley and Reddish in the same Journal. Taylor made frequent exhibits at subsequent meetings and these included the first record of *Hydrobia jenkinsi* var. *carinata* from the canal at Bardsley (1899) and sinistral *Viviparus viviparus* from the same canal (1902). He read his first paper in 1897 dealing with the local Mollusca, some fifty-eight species being recorded (*J. Conchol.* **9**, 1898, 49–53). A further paper by him on *Hydrobia jenkinsi* at Droylsden appeared in 1900. In 1902 he contributed a paper on "Fluviatile Shells" to *Science Gossip*. This dealt with *Physa heterostropha* and *Planorbis dilatatus* in the canal at Guide Bridge, both found by him and W. J. Guy in 1900. Reports on conducted rambles appeared later, that on one to Bardsley in 1903 and another to Droylsden in 1904. These rambles were always highly instructive with such a leader.

It was on 28 April 1900 that Taylor made a discovery that will always be associated with his name. His sharp eyes had detected a tiny freshwater operculate snail in the canal near Fairfield Locks, Droylsden, Lancashire. This was a form unknown to him and he submitted specimens to E. A. Smith at the British Museum (Natural History) who named the shell in his honour *Paludestrina taylori*. Later on, after considerable study by Taylor and myself, we published a joint paper in the *Journal* for 1904 on the habits and reproduction of the species. At that time we were in communication with E. von Martens and submitted specimens to him asking his opinion on the close resemblance between *P. taylori* and his *Hydrobia steinii*. He considered them to be quite distinct. Our own studies of American forms had led us to the conclusion that *P. taylori* really belonged to the genus *Amnicola*. Further research in 1936 by Dr. C. C. van Regteren Altena, of Amsterdam, proved that *taylori* was identical with *steinii* as we at first suspected, but it was found by the same authority that *steinii* did not belong to *Hydrobia*, *Bythinella*, or *Amnicola*, but to a new genus which he called *Marstoniopsis*. In a living state, outside our country, the species occurs in Holland, Germany, Poland, Latvia, Denmark and Sweden. It is reported fossil from the Cromerian of West Runton and from the Holocene of Kalundborg and near Rostock.

In July 1904, on Taylor's invitation, I took Fred Booth, of Saltaire, to see an exhibition at the Oldham Art Gallery. There we met J. Whitehead of Stalybridge (cryptogamic botanist) and J. Pulfer (geologist) among other naturalists. Taylor gave a short informative address on his fine and complete collection of British non-marine shells presented by him to the town in 1898.

In December 1914 Taylor gave a lecture to the Oldham Microscopical Society on "Local Freshwater Shells" adding much further information to his earlier 1897 paper. He was an honorary member of that Society as well as a founder member of the Oldham Natural History Society.

In the *Lancashire and Cheshire Naturalist* for October 1917 (pp. 214–5) Taylor published a most interesting paper on *Planorbis dilatatus* and *Physa heterostropha* in the Oldham district, giving observations on water temperature and other matters. In February 1918 he showed me with great delight a sinistral specimen of *M. steinii* (= *taylori*) he had discovered in the Reddish canal. Later that year he conducted members of the Lancashire and Cheshire Fauna Committee on a ramble to Bardsley and Riversdale. He was an active member of that Committee and of the North East Lancashire Naturalists' Union and the United Field Naturalists' Society, of which he was President in 1918–19, referee in Mollusca and birds, and was elected honorary member in 1948.

In 1921 he worked assiduously at a refuse-tip at Oakwood Mill, Romiley, Cheshire, and obtained a series of interesting molluscs, including some unusually large and richly coloured specimens of *Oxychilus rogersi.* He contributed a short but interesting detailed note on his finds to the *Lancashire and Cheshire Naturalist* of that year. In that same year he presented to the Oldham Museum a fine collection of exotic shells acquired by means of exchange of British specimens.

Taylor did not confine himself to localities near his home but travelled far and wide in search of shells. He visited Tenby, Cranham Woods, Wicken Fen and various places in Cornwall and Devon in order to obtain rare or local species. He always returned with plenty of good material and lavishly distributed duplicates among his friends. One of his most distant journeys was to West Sutherland where, in June 1939, he trailed up to Loch Fleodoch Coire to collect and study an extremely local freshwater snail.

Taylor acquired many reversed shells in the course of his collecting: they included *Helix pomatia*, *H. aspersa*, *Hygromia striolata*, *Cochlicella acuta* and *Oxychilus draparnaldi*, in addition to those previously mentioned. He was always on the look-out for snails imported with fruit. In December 1936 he exhibited at one of our meetings two specimens of the Jamaican land shell, *Thelidomus aspera* (F.), taken alive in bananas at Oldham.

Our departed friend was interested in many other things besides conchology. He was an authority on British birds and often lectured on them. He spent many hours with jovial companions in the field studying their habits and made excursions far afield. His close companion for over thirty-five years, John Armitage, has contributed a eulogy to the *Oldham Chronicle* (19, 26 February and 5 March) on these activities and I am indebted to him for several details regarding his life. Taylor's own collection of eggs of British breeding birds is said to be one of the finest in the country. It was supplemented with historic sets of eggs of rare birds acquired from other private collectors and was housed in a handsome 34 drawer cabinet designed and constructed by Taylor and his son Hubert. It was purchased by the Oldham Libraries Committee in 1931 and is available for study and inspection at the Study Centre, Werneth Park, Oldham. Taylor was acknowledged as an authority on the merlin and many other birds of the hills, and some years ago he was unanimously elected honorary member of the Jourdain Society, a body of expert ornithologists and oölogists in London.

J. WILFRID JACKSON.

R. H. Moses, 1871–1949.

Robert Henson Moses, who was born in Shrewsbury in 1871 and died on 13 June 1949, came from a family with strong medical and zoological trends. Thus, one of his uncles, Henry Moses, M.D., wrote *Sketches of India* in 1850, and his grandfather, Dr. J. W. Moses of St. Asaph, was a well-known naturalist in his day. Another distinguished ancestor was William Cheselden (1688–1752), who wrote the *Anatomy of the Human Body* in 1713 and the splendid *Anatomy of the Bones* in 1733. He became one of the principal surgeons at St. Thomas' Hospital in 1719 and introduced the then entirely new lateral technique for lithotomy, besides being the first surgeon to attempt the creation of an artificial pupil for certain forms of blindness. It is not surprising, therefore, that R. H. Moses was an ardent student of anything relating to Nature.

From school he went directly as an apprentice to his father's pharmaceutical business and during his whole life as a dispensing chemist he studied and collected in many biological fields. He disposed of his plants, birds' eggs, and Lepidoptera some time ago in the realization that his favourite phylum, the Mollusca, could more than fill his spare time. He amassed a collection of some thousands of species, almost entirely by exchange, and he had correspondents all over the world.

As a London member of the Conchological Society he will be sadly missed by many, even as he will by a far larger circle of friends, for he was a delightful companion, modest and with an old-world kindliness, tireless in his striving for accuracy and ever ready to give from the wide knowledge of the Mollusca which he had acquired during a period of more than sixty years of assiduous collecting. He was an enthusiastic field worker, collecting widely on the Kent coast, particularly near Dover and Sandwich when he resided in those districts. He published two short notes in this *Journal*, viz. one on *Clausilia dubia* Draparnaud (**20**, 339) and one on two live foreign bivalves collected by him near Sandwich (**21**, 324).

His collection is going to the Haselmere Educational Museum, where, it is understood, a part will be on exhibition and the whole will be available for study.

He is survived by a widow, two sons and three daughters.

Arthur Blok.

E. Stainton, 1885–1949.

Ernest Stainton, born at Doncaster on 1 March 1885, was the son of George William and Lucy Gant Stainton, one of a family of seven. He never married, and died on 19 March 1949. Stainton was apprenticed to a firm of confectioners in Hall Gate, Doncaster ; while with Messrs. Slacks he acquired a thoroughness in his work which characterized his researches during the whole of his life. He left nothing to chance and gave due regard to every detail. For many years he was a clerk in the West Carriage Shop of the L.N.E.R. During the 1914–18 war he served with the Royal Scots Fusiliers and saw service in Russia and Ireland.

Stainton was elected a member of the Conchological Society in 1914. As a conchologist and freshwater biologist his work was always reliable. He did a considerable amount of breeding of land and freshwater Mollusca, and was particularly interested in the eggs. He gave freely of his knowledge, helping others less experienced than himself. His love for young people was well known and there are many who will remember him with gratitude for the help he gave them in natural history.

ELSIE M. MOREHOUSE.

NOTE ON THE RADULA OF *FUSITRITION*.

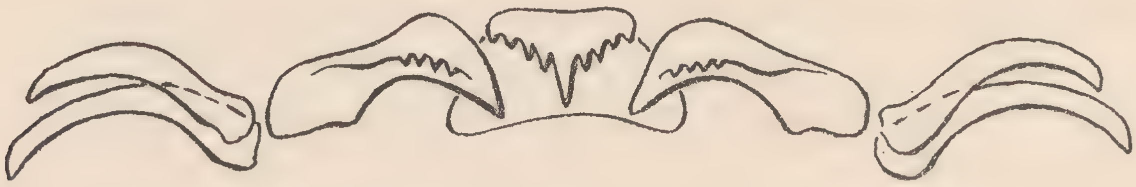
By K. H. BARNARD, South African Museum.

(*Read before the Society*, 15 *October* 1949.)

DR. K. M. WHITE (*J. Conchol.* **23**, 1948, 3) has described the anatomy of a species of this genus, stating that it is in general similar to that of *Buccinum* and that the radula has the formula 1.1.1, comprising a central tooth and one three-pronged lateral. It would thus appear to be Rhachiglossate.

If, however, the radula is properly prepared and mounted with the teeth spread out, it is seen to be typically Taenioglossate, consisting of a central tooth, one lateral, and two marginals (uncini), 2.1.1.1.2.

As the generic name is compounded of *Fusus*, a Rhachiglossate form, and *Triton*, a Taenioglossate form, the erroneous implication that the radula is Rhachiglossate in composition might be confusing.



Radular teeth of *Fusitriton murrayi* (E. A. Smith).

As regards the species, it seems to me unlikely that there are two *species* with such extraordinarily close resemblance in their shells, living in the same area, as *murrayi* Smith and *algoensis* Tomlin. In the South African Museum there are many of these shells, obtained by the Cape Government trawler *Pieter Faure*, and, as is not uncommon in shells with cancellate sculpture, they show quite a lot of variation in detail.

With all respect to my friend Mr. Tomlin, I propose to retain the name *Fusitriton murrayi* (E. A. Smith).

EDITORIAL NOTES.

THE following extract from a letter written by Dr. D. C. Swan, of the Waite Agricultural Research Institute, University of Adelaide, shows what a nuisance a normally innocuous snail may become when transported to a new environment. About fifty years ago *Helicella itala* (L.) became established at Warooka, a corn-growing district near the southern end of the Yorke Peninsula, South Australia. " The snail thrived and has spread until it has colonized all the foot-like bottom end of the peninsula. This part has a winter rainfall of about 27 inches yearly, with a fairly hot, dry summer. The climate is, in fact, a perfect replica of the Mediterranean-type climate. It appears to have suited *Helicella*, and it now occurs on every square yard of the land surface, I should think, and in grassy stubbles reaches everywhere numbers of the order of 20 to 50 per square foot. . . . Its economic importance arises from its habit of climbing vegetation in mid-summer, particularly on isolated hot days ; in the dry weather of late summer it aestivates much as does *Euparypha pisana*, in dense clusters on shrubs, fence posts, etc. In the area in question, it becomes extremely numerous in any growing cereal crop. In view of the cool relatively long growing season of the affected district, malting barley is the main crop, representing five-sixths of annual cereal production in the locality. Barley matures in December and is reaped at once, since the heads tend to break off when ripe. Wheat harvesting is left until January and by then hot days, approaching 100° F., may occur. On such days the snails migrate *en masse* to the ears of the ripe wheat and are harvested with the grain. In modern machinery they are pulped and this has most undesirable effects. Moving parts may be literally gummed up, causing frequent stoppages to clean conveyors, etc. ; the rate of flow of the threshed grain is seriously reduced. The harvested product that goes into the bags contains an admixture of crushed snails ; in bad cases this may reach 50 per cent, and the contents of the bag set in a firm mass."

A special feature of the *National Geographic Magazine*, volume **96**, number 1, July 1949, is an article by Rutherford Platt entitled " Shells take you over world horizons," illustrated by 32 plates of natural colour photographs of shells from all parts of the world.

The collection of the late C. H. Moore has been disposed of as follows : his local shells have been given to the Stalybridge Library and Art Gallery, a small collection of British shells has gone to Stockport Museum, and all his foreign shells are in Leeds Museum.

A paper by A. D. J. Meeuse and B. Hubert on " The Mollusc Fauna of Glasshouses in the Netherlands " (*Basteria* **13**, 1949, 1–30, pl. 1–3) not only gives an account of the greenhouse snails of Holland, but refers to alien Mollusca recorded from other European countries, including the

British Isles, and concludes with a comprehensive bibliography. *Opeas mauritianum* (Pfeiffer), collected by Dr. Meeuse in the Belfast botanical gardens, is new to our list of introduced species.

Dr. S. B. Kendall, of the Veterinary Laboratory, Weybridge, has been breeding most of the British species of *Lymnaea* in connection with researches on the bionomics of the liver-fluke. A paper in the *Journal of Helminthology* **23**, 1949, 57–68, deals with the resistance of *L. truncatula* to conditions of drought.

The statement in the last number of the *Journal* (p. 52) that the late Lieut.-Colonel Peile's collection of Streptaxidae and slides of radulae have gone to Edinburgh University is incorrect; they are deposited in the Royal Scottish Museum.

Punch **217**, 17 August 1949, 196 :—

Impending Apology

"1.10 THE NATURALIST.
46—Slugs and Snails.
Brian Vesey-Fitzgerald introduces
Alex Comfort and Bernard Verdcourt."
Radio Times.

REVIEWS.

The Sea Shore. Professor C. M. YONGE, D.Sc., F.R.S.E., F.R.S. Pp. xvi, 311; 40 coloured plates (61 colour photographs), 32 half-tone plates (62 photographs), 88 text-figures. London: Collins (*The New Naturalist*, volume 12), 1949. Price 21*s.* net.

TO attempt a critical review of this delightful book would be almost an impertinence. Professor Yonge is so well known as an expert on marine biology that his name on the title page is a hall-mark guaranteeing the excellence of the text, while the plates, most of which are reproductions of photographs by Dr. D. P. Wilson, are the finest portrayals we have seen of *living* sea-shore animals. Mollusca naturally feature prominently in a work on littoral life, and special mention must be made of the remarkable colour photographs of *Octopus* and *Lima*. Anyone who has not yet acquired a copy of this book should hasten to rectify the omission.

Slugs (Mollusca). H. E. QUICK, M.B., B.Sc., F.R.C.S. Pp. 29; 2 half-tone plates (25 figures), 26 text-figures. *Synopses of the British Fauna*, No. 8. Linnean Society of London, Burlington House, Piccadilly, W. 1. June 1949. Price 2*s.* 6*d.* net.

SINCE the completion in 1907 of J. W. Taylor's monumental volume on British Slugs (*Monograph* 2) several additions have been made to the

British list, particularly during the last twenty years, and no comprehensive account of all the species now known in this country has been available. Dr. Quick's admirable Synopsis makes good this deficiency and not only provides an authoritative guide to the determination of the species, but also gives a great deal of information in a condensed form on the habitats, life-history, variation, British and foreign distribution, etc., of the Arionidae, Limacidae and *Testacella.* The author's high reputation as a skilled malacologist and accurate observer is enhanced by this latest addition to the Linnean Society's series of Synopses, which it is hoped will do much to stimulate interest in these too often neglected animals. There is still much to be learnt about the distribution, ecology and bionomics of slugs, and it is highly probable that other species await recognition. The field for research is wide and offers abundant opportunity for the keen student of Mollusca whose outlook is not circumscribed by the shell cabinet.

A Key to the British Fresh- and Brackish-water Gastropods with notes on their Ecology. T. T. Macan, M.A., Ph.D. Illustrated by R. Douglas Cooper, F.R.S.A. Pp. 45 ; 15 figures. Freshwater Biological Association, *Scientific Publication* No. 13. October 1949. Price 2*s.* (postage 1½*d.*), obtainable from the Director, Wray Castle, Ambleside, Westmorland.

As the title indicates, this pamphlet furnishes a key to the determination of our freshwater and semi-marine snails, illustrated by line drawings of the shell of each species. The brief descriptions in conjunction with the figures should render identification easy even by those having no special acquaintance with Mollusca. The admirably executed illustrations are for the most part accurate representations, though a few fail to satisfy the critical eye of a conchologist. The inclusion of certain paludal forms, such as *Zonitoides nitidus*, *Succinea*, *Carychium* and *Vertigo*, seems superfluous and is hardly justified by the statement that " there is no sharp line dividing aquatic from terrestrial species " ; it would have been preferable to restrict the Key to the definitely aquatic Prosobranchia and Basommatophora. This publication will certainly fulfil its avowed purpose of relieving the freshwater biologist from the necessity of buying a book which includes the land snails as well as those with which he is concerned.

***Ancylus fluviatilis* Müller in stagnant water.**—Mr. B. R. Laurence found a number of the whitish form of *A. fluviatilis* on the smooth sides of a cement reservoir above Rum Bay, Plymouth, April 1949. The occurrence of this species in still water is unusual ; Boycott (*J. Animal Ecol.* 5, 142) cites a few instances and states that " If the necessary conditions of hard surfaces and absence of mud are satisfied, quickly running water is not obligatory."

B. Verdcourt.

(*Read before the Society*, 15 *October* 1949.)

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

688th Meeting held at the British Museum (Natural History), 23 April 1949.

Mr. R. Winckworth, Vice-President, in the chair.

Election of Members.

The following were elected to membership of the Society :—

Philip W. Curnow, 31 Sciennes Road, Edinburgh 9.
George William Pitchford, 65 King Street, Southwell, Notts.

Communication.

Lieut.-Colonel C. J. F. Bensley gave an account of attacks on *Lymnaea stagnalis* in captivity by pond-snails, *L. stagnalis* and *Planorbis corneus* (see *Journal* **23**, 61.).

Exhibits.

Mr. T. Pain : *Pila* (*Forbesopomus*) *atalanta* Bequaert and Clench ; also a series of British *Lymnaea.*

Mr. G. L. Wilkins : A series of *Harpa*, including a specimen of the rare *H. virginalis* Sowerby ; also a copy of Martin Lister's *Conchyliorum Bivalvium*, privately printed for the author in 1696.

Lieut.-Colonel Bensley : specimens illustrating his communication.

689th Meeting, held at the British Museum (Natural History), 21 May 1949.

Mr. A. E. Ellis, Vice-President, in the chair.

Election of Member.

Tromsø Museum (Zoologisk Ard.), Tromsø, Norway.

Communications.

" *Divaricella divaricata* (L.) living in Scilly," by T. G. W. Fowler.
" The Distribution of *Pila speciosa* (Philippi)," by T. Pain.

Exhibits.

Special exhibits : British Loricata (Chitons) and *Pholas.*

Mr. T. Pain : a series of *Placostylus* from New Caledonia and specimens to illustrate his paper.

Mr. D. E. Brown : *Lanistes ovum* Peters from Nyasaland kept alive at the Zoological Gardens, London.

Mr. G. L. Wilkins : a series of *Pholas* including all the British species, several *in situ* in their burrows in chalk and red sandstone.

690th Meeting, held at the British Museum (Natural History), 15 October 1949.

Mr. A. E. Salisbury, Vice-President, in the chair.

Election of Member.

Kay Göran Liliefelt, Gustaf Rydbergsgatan 2, Malmö, Sweden.

Member Deceased.

Mr. Salisbury announced the death of Robert Henson Moses on 12 June 1949.

Communications.

"Large *Cepaea nemoralis* in the Locard Collection," by Dr. A. Comfort.

"Note on the Radula of *Fusitriton*," by Dr. K. H. Barnard.

"A Giant Whelk," by Piet Kaas.

"The Brackish-water Mollusca of Bromborough Pool, Cheshire," by Mrs. N. F. McMillan.

"*Ancylus fluviatilis* Müller in stagnant water," by B. Verdcourt.

"A new locality for *Ena montana* (Draparnaud)," by Professor the Rev. Canon L. W. Grensted.

"*Acme fusca* (Montagu) near Doncaster," by A. S. Cook.

"*Limapontia depressa* Alder and Hancock in Suffolk and Glamorgan," by H. E. Quick.

Exhibits.

Special exhibits : *Ficus* and Clausiliidae.

Mr. G. L. Wilkins : series of *Ficus* and a wax model of *Ficus ficus* (L.).

Mr. L. W. Stratton : *Ficus nexilis* from the Barton beds ; British and Continental Clausiliidae.

Dr. A. Comfort : European Clausiliidae ; *Zoogenetes harpa* (Say) from the Riffelalp, Zermatt.

Mr. A. E. Ellis : *Laciniaria biplicata* (Montagu) from several old localities near London ; recent Continental examples of Clausiliidae that occurred in the English Pleistocene ; *Hydrobia jenkinsi* Smith from near Land's End, Cornwall W.

Mr. T. Pain : a series of *Pollicaria*.

691st Meeting, held at the British Museum (Natural History), 19 November 1949.

Mr. A. E. Salisbury, Vice-President, in the chair.

Election of Members.

J. F. Martin de Bartolomé, 89 Onslow Gardens, London, S.W. 7.

W. J. Rees, D.Sc., British Museum (Natural History), Cromwell Road, London, S.W. 7.

Communication.

"Further observations on *Charonia lampas* (L.)," by B. S. Kisch.

Exhibits.

Mr. G. L. Wilkins: species of *Clavagella*.

Mr. T. Pain: *Placostylus ambagiosus* Suter and subspecies, collected by A. W. B. Powell on North Auckland Peninsula, New Zealand (described in *Rec. Auck. Inst. Mus.* 3, 1947, 173).

Mr. A. H. Turner: *Laciniaria biplicata* (Montagu) from Bickenhall, near Taunton, S. Somerset.

Mr. A. G. Davis: lime concrete containing freshwater shells, made from Thames ballast in the early nineteenth century, from the foundations of buildings demolished for the site of the Exhibition, Waterloo, London.

LIST OF MEMBERS.

Changes of Address.

ARKELL, A. J., O.B.E., Department of Egyptology, University College, Gower Street, London, W.C. 1.

BENSLEY, Lieut.-Colonel C. J. F., Educational Museum, Haslemere, Surrey.

QUICK, H. E., M.B., B.Sc., F.R.C.S., 59 Alexandra Road, Reading, Berks.

Members Deceased.

P. O. BARNETT; R. H. MOSES; Mrs. HELEN I. ROWLAND (née TUCKER).

Malacological Society of London

Hon. Sec.: MAJOR G. I. CRAWFORD, 18, East Drive, Carshalton, Surrey.

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THE JOURNAL OF CONCHOLOGY

Back parts (when stock permits) can be had from MR. D. NUTT (A. G. BERRY), 212 SHAFTESBURY AVENUE, W.C. 2, and from the Hon-Librarian and Curator of the Society, MR. W. THURGOOD, 16 MOSS GARDENS, ALWOODLEY PARK, LEEDS.

LAND MOLLUSCA OF NORTH AMERICA

(North of Mexico)

By

HENRY A. PILSBRY

Curator of Mollusks, Academy of Natural Sciences of Philadelphia.

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FARQUHAR, J.

An attached pearl in a *Tellina*.—When examining a batch of *Tellina interrupta* Wood from the collection of the late Lieut.-Col. A. J. Peile, I found a specimen containing a sizeable adherent pearl in the left valve.

This growth, situated at just about the centre of the area enclosed by the pallial line, is about 3 mm. long, 1·5 mm. thick and 3 mm. in maximum height. It is of substantially inverted U-shape in front elevation and attached at its flat bottom end to the shell, with its domed end extending into the cavity of the shell. Its longer dimension runs parallel to the ribs of the shell, an examination of the outside of which revealed at the area of the pearl four very minute openings stained brown and extending along the apex of one of the ribs over a distance of about 1 mm. Evidently this rib had become parasitized and the mollusc threw up the pearl in the usual way of defence. The pearl has the glossy yellow surface which characterizes the interior of the shell. The shell measures 54·5 × 28·3 mm. × 14 mm., and was taken alive.

A. BLOK.

Further note on *Divaricella divaricata* (L.).—In the last number of the *Journal* (**23**, 68) I reported finding a living specimen of *Divaricella divaricata* (L.) off Tresco, Isles of Scilly. On 1 May 1950 I obtained a second living specimen, measuring 11 mm., in the same locality. Nearly five hours' dredging at the same spot on this and two subsequent days yielded no further example of *D. divaricata*, which shows how exceedingly scarce this species is.

T. G. W. FOWLER.

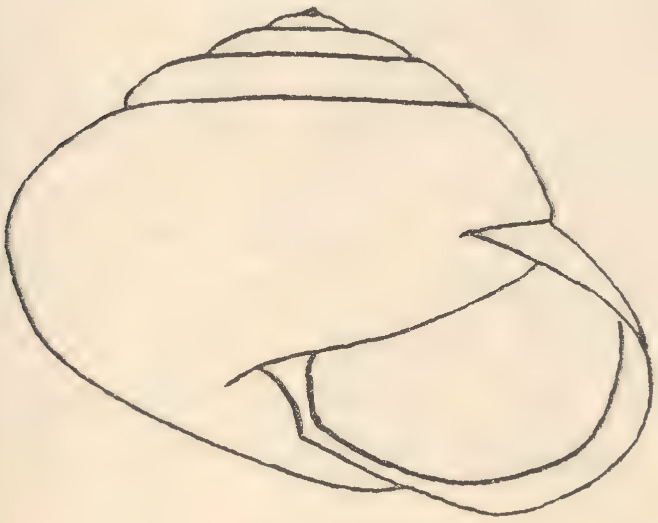
HYGROMIA CINCTELLA (DRAPARNAUD) IN ENGLAND.

By A. Comfort.

(*Read before the Society, 20 May 1950.*)

In 1919 Kennard and Woodward announced the discovery of colonies of *Hygromia limbata* (Draparnaud) near Teignmouth. Considerable field work was done in this area (Huggins, 1922, Ellis, 1940) and the species has been under observation ever since. In April 1950 collecting was begun between Torquay and Brixham, along the Torbay coast, South Devon, to see whether any new colonies could be found in similar habitats south of the known range. No new stations of *H. limbata* were found, but at two localities in the Paignton area a second species of *Hygromia*, *H. cinctella* (Draparnaud) was found in large numbers.

The colonies were about two miles apart. The first was among ivy, grass, and umbelliferous plants in a shallow ditch along a south-facing drystone wall bounding the park on top of Roundham Head, about 70 yards north of the flagstaff. On the other side of the wall was a small wood, part of a private shrubbery which could not be investigated. Shells were also found on the paths and promenade below Goodrington cliff gardens adjoining the park, having fallen from thick masses of *Carpobrotus edulis* ("*Mesembryanthemum*") on the cliff face. Dead shells and young living snails were plentiful along the wall, and the appearance was that of a well-established colony where breeding was in progress (National Grid 20/897600).



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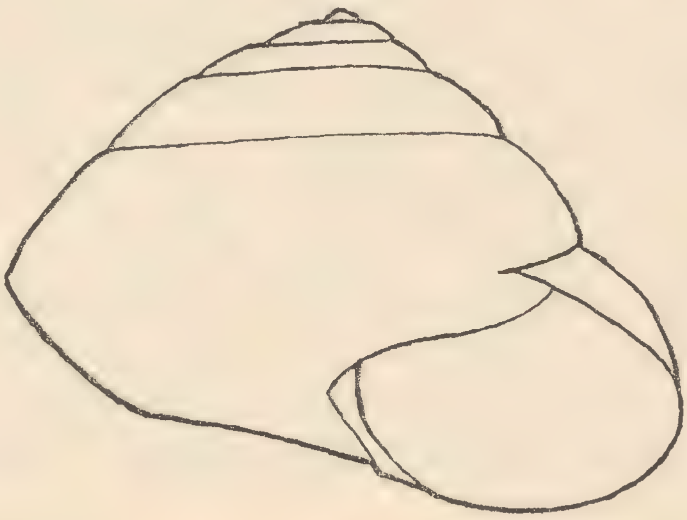

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Fig. 1.—*Hygromia limbata* (Draparnaud), × 4, Shaldon.
Fig. 2.—*H. cinctella* (Draparnaud), × 4, Paignton.

A second locality was later found at the opposite end of Paignton beach, toward Preston (20/896619) under stones, rubbish and nettles in an angle between two drystone walls, adjacent to the footpath connecting the beach with a railway bridge immediately south of Preston gasworks. One of these walls flanks the railway, and further specimens were found along the railway bank southward from this point for about 200 yards. A dead shell was found on the cliff face above Hollicombe beach, 400 yards to the north. Both localities were shared with a large number of indigenous species, *Ashfordia granulata* predominating. *Oxychilus draparnaldi* and *Testacella maugei* are both plentiful in the Roundham locality.

Search for further colonies to the south of Goodrington, at Elberry Cove, Broadsands and inland produced no result. Both the stations are associated with cultivated ground and with introduced exotic plants. The gardens at Roundham were constructed about 15 years ago, and planted with shrubs given by a local horticulturalist and naturalist. Palms, bamboos, white arums and camellias are naturalized in a very large number of local gardens adjacent to both sites.

Specimens of *H. cinctella* from Paignton were compared with *H. limbata* taken during the same period at Shaldon, where this species is extremely well established in hedge banks. *H. cinctella* has a thinner, smaller shell, conical, reddish brown or horn-coloured, with a sharp peripheral keel which gives it the general outline of a *Dendrotrochus*, and a thin opaque white band coincident with the keel. Both species are figured by Watson (1919). The animal resembles that of *H. limbata* in external form, but is paler in colour and smaller. *H. cinctella* is indigenous in central and southern France, the Mediterranean and southern Alps, and has within recent times penetrated into western Switzerland[1]; it is rather less hygrophile than *H. limbata*. Until the range and habits of this species in the Paignton area have been fully investigated, no firm conclusion can be reached about its origin, but it is almost certainly an introduction. The theories proposed by Huggins and by Stelfox to explain the presence of *H. limbata* could only be extended with difficulty to a species recorded from an urban area. The climate of South Devon is, however, very suitable for the survival of southern forms, and considerable dispersal has probably already taken place. Further collecting and field study will be reported later.

REFERENCES.

ELLIS, A. E., 1940. Some Devon Land Snails. *J. Conchol.* **21**, 190.

HUGGINS, H. C., 1922. The South Devon race of *Hygromia limbata* (*Drap.*). *J. Conchol.* **16**, 297–301.

KENNARD, A. S., and WOODWARD, B. B., 1918. On the occurrence in England of *Hygromia odeca* (Locard). *Proc. Malac. Soc.* **13**, 14–15.

WATSON, H., 1919. Notes on *Hygromia limbata* (Drap.). *Proc. Malac. Soc.* **13**, 120–132, pl. 2, 3.

***Crepidula fornicata* (L.) in Torbay.**—Since 1945, when Bloomer (*J. Conchol.* **22**, 147) published an account of the spread of *Crepidula fornicata* (L.) on the coast of Dorset, I have kept a watch for this species on the beach at Paignton, South Devon. On 27 January 1950 I found a living specimen, measuring 60 × 45 mm., on an old shell of *Buccinum undatum* L., proving that the vanguard of the slipper-limpet has now reached this part of the coast.

PHILIP POMEROY MILMAN.

(*Read before the Society, 22 April 1950.*)

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[1] introduced in Hungary and Czechoslovakia.

HABITAT OF *CLAUSILIA ROLPHII* TURTON.

By L. W. STRATTON.

(*Read before the Society, 18 February 1950.*)

THE discovery in 1948 of *Clausilia rolphii* Turton on Studham Common, a new addition to the fauna of Bedfordshire, prompts these observations on its habitats in this area.

The area under consideration is shown on fig. 1, and is partly in Bedfordshire and partly in Hertfordshire. The road from Markyate to Whipsnade (Buckwood Road) lies on a narrow strip of valley gravel. On either side of this lie bands of the Middle and Upper Chalk, separated by a thin layer of chalk rock. The slopes above these bands are clay with flints (fig. 2).

For the purpose of these observations four areas are to be considered, namely Deadmansey Wood, the scrub area so marked on fig. 1, the valley bottom, and that small wood on the north slope marked C. Deadmansey Wood, on the crown of the southern slope, is a mixed wood containing some fine beeches, with a ridge of beeches along its southern edge. The ground layer consists of patches of bramble and bracken, and the paths are very miry with clay. Of the scrub area, Sir Edward Salisbury says that when he first knew it nearly fifty years ago it had recently been under the plough. The lower slopes are now densely covered with hawthorn, the scrub becoming more open further up with areas of coarse grass. Soil tests over this long period have shown increasing acidity due to leaching. The area is very interesting botanically, and is also excellent hunting ground for butterflies.

Mr. B. Verdcourt has worked Deadmansey Wood and the scrub very thoroughly and he has furnished the following list and notes, the results of ten visits. The letters B.T.R. indicate the beech ridge :—

Columella edentula (Drap.) : one only on log under leaves, B.T.R.
Cochlicopa lubrica (Müller) : scarce under moss.
Punctum pygmaeum (Drap.) : under dead leaves.
Discus rotundatus (Müller) : not common, but well distributed.
Do. var. *alba* Moq. : under leaves, B.T.R.
Arion circumscriptus Johnston : several, B.T.R.
A. ater (L.) : common.
Hygromia hispida (L.) : open part of wood.
Euconulus fulvus (Müller) : scarce under dead leaves.
Retinella radiatula (Alder) : scarce under moss in open part of wood ; var. *viridula* Menke more plentiful than typical form.
Retinella nitidula (Drap.) : fairly common, B.T.R.
Oxychilus rogersi (B. B. Woodward) : frequent but sporadic.
Oxychilus cellarius (Müller) : scarce under moss.
Vitrea crystallina (Müller) : one under beech leaves, B.T.R.
Vitrina pellucida (Müller) : frequent under moss.
Agriolimax reticulatus (Müller) : in open bushy parts.
Limax marginatus Müller : scarce on beech tree boles.

None of these is included in Boycott's calcicole species (*J. Ecol.* 22, 29 seq.) and only *Hygromia hispida* and *Oxychilus cellarius* are in his list of those which prefer lime. It would appear therefore, that the wood is definitely lacking in calcium. The scrub area produced three species only; *Hygromia hispida*, *Retinella radiatula* and *Agriolimax reticulatus*, all in small numbers.

Clausilia rolphii was first found at A (fig. 1) on 30 May 1948. The locus, on the valley gravel, is a hedgerow consisting of hawthorn trees, young beech and many hornbeams which have been pollarded, with the result that they have large, gnarled, moss-grown stumps. Between the hedge and the road is a shallow ditch, much overgrown with nettles, and a grass verge, in all some 10 feet wide. Above the hedge is a field which had a corn crop in 1948 and 1949. This field is entirely on gravel and chalk. Some remarks of Sir Edward Salisbury's in a letter are very applicable to this hedgerow: "On the slopes the leached soil particles would tend to be removed in greater or less degree by erosion. In a wood margin, and in its artificial equivalent the hedgerow, growing on a base-rich subsoil, the surface soil may be appreciably richer in bases than the surface soil in the open, by reason of the bases (especially calcium) released from the annual dressings of dead leaves which there decay rapidly, instead of slowly as in the shade of the wood itself." The hedgerow

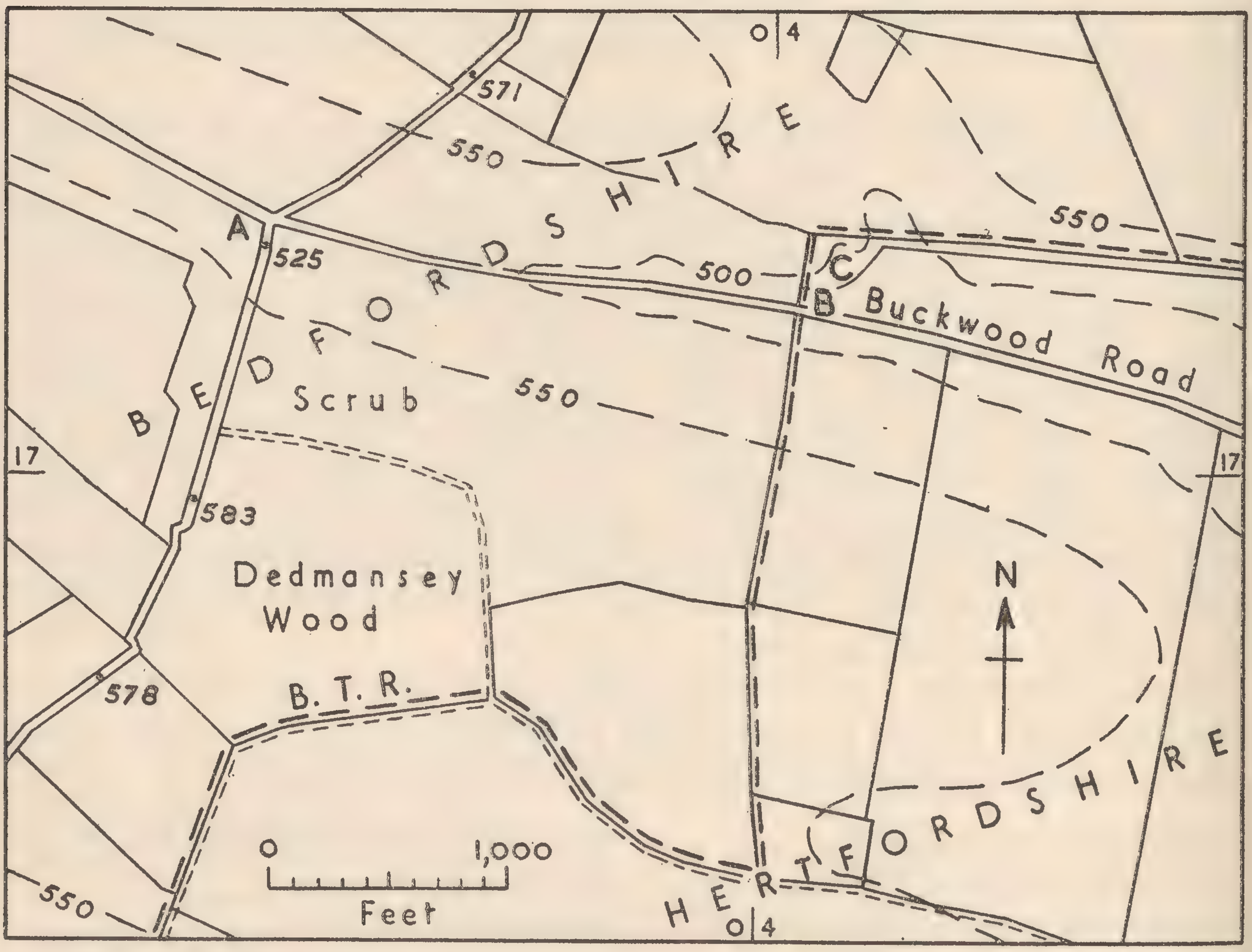

FIG. 1.—Part of Studham Common.[1]

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[1] Reproduced from the Ordnance Survey map with the sanction of the Controller of H.M. Stationery Office.

in question, on a subsoil of chalk, at the foot of a slope with deciduous trees and bushes, fulfils all these conditions and is probably very rich in calcium. The bank of the hedge has many large patches of loose moss, and it was only in this moss that *Clausilia rolphii* was found. Other species occurring with it were *Cochlicopa lubrica*, *Azeca goodalli* (Fér.), *Discus rotundatus*, *Arion circumscriptus*, *Hygromia hispida*, *Helix hortensis* Müller, *Retinella nitidula*, *Oxychilus alliarius* (Miller), *O. rogersi* and *Vitrina pellucida*, while *Marpessa laminata* (Montagu) and *Clausilia bidentata* (Ström) were found on the hornbeam stumps.

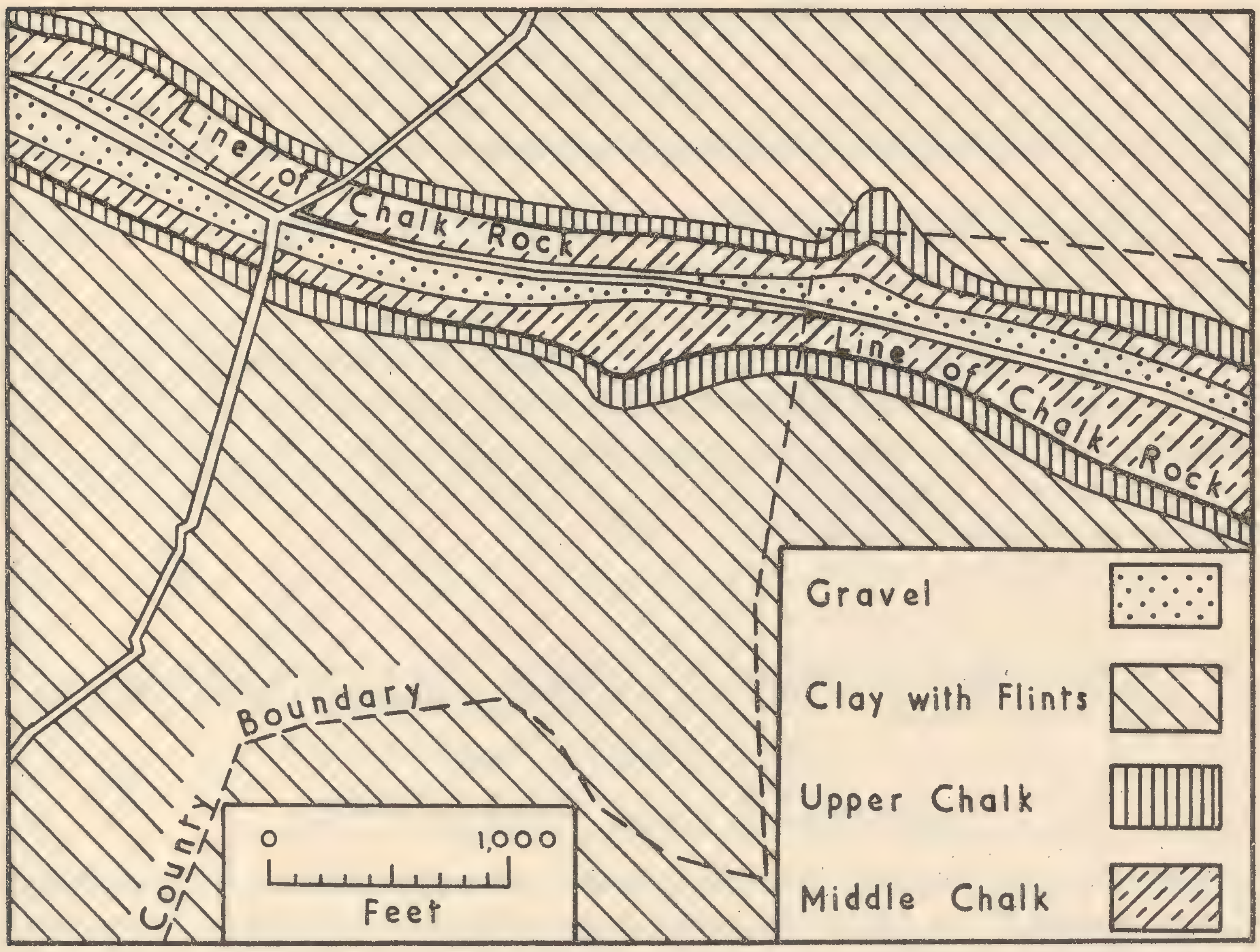


FIG. 2.—Geological Map of part of Studham Common.

On the opposite side of the road behind the hedge and also on the valley gravel is a ditch about 3 feet deep. This is dry for the greater part of the year. In it and on its edges were found many *Monacha cantiana* (Montagu), a fair number of *Hygromia striolata* (Pfeiffer), some *Oxychilus cellarius* under the grass and *Helix hortensis*, mostly var. *lutea* 12345, but also one var. *lutea* 123(45), one var. *incarnata* 1(23)45 and one var. *subalbida concolor*. The first two species generally favour such open situations.

Later in 1948 Mr. Verdcourt found *C. rolphii* at B, again in the foot of the hedgerow. This habitat, very similar to A except that the hedgerow is at right-angles to the slope, is just inside Herts, and makes the second record for the county. The first was made by F. Podmore in 1875, confirmed by A. G. Stubbs in 1888, for Gallows Hill, between Hertford and Ware. This, a steep chalk escarpment above the River Lea, has a typically calcicole snail fauna, including *Pomatias elegans* (Müller), and several varieties of *Helix pomatia* L. from Gallows Hill found by Stubbs were figured in Taylor's *Monograph* (vol. 3). These two species are still there, but two visits in 1948 failed to reveal *Clausilia rolphii.*

The third locus for *C. rolphii* at Studham, shown at C in fig. 1, and also in Herts, was found during the summer of 1949. Just inside the wood is an outcrop of chalk rock, much of it moss-grown and shaded by hazels. *C. rolphii* again occurred in the moss with *Hygromia hispida*, *Cochlicopa lubrica* and *Retinella nitidula.* The complete dryness, following the long drought, was all against good snailing, so that no fair indication of associated species can be given. On the same day the presence of *C. rolphii* was confirmed for a considerable distance westward along the hedgerow from A. There are several other suitable places in the locality, and it will probably be found that this species is generally distributed at Studham.

These observations confirm those of Boycott that " *Clausilia rolphii* can prosper in hedges and a variety of scrubby calcareous loci ", and Ellis, " hedges and copses on calcareous soil." They also seem to point to this snail being of a geophilous habit, for there was ample opportunity at Studham for it to leave the ground, as shown by *Marpessa laminata* and *Clausilia bidentata* ascending trees. Mr. A. E. Ellis tells me that he has never observed *C. rolphii* on trees ; it would be interesting to know the experience of other observers.

PLANORBIS CORNEUS (L.) VAR. *RUBRA* OLDHAM.

By L. W. STRATTON.

(*Read before the Society, 18 February 1950.*)

IN 1921 Charles Oldham introduced into Cross Oak Pond, Berkhamstead, Herts, a small number of *Planorbis corneus* var. *rubra*, the young of a batch brought in the same year from a pond at Barnet. Cross Oak was then untenanted by *P. corneus.* By 1927 it was heavily stocked with var. *rubra* (Oldham, 1928).

This red-bodied form is albinistic so far as the animal is concerned, the crimson colour being due to the haemoglobin in the blood showing through the transparent, unpigmented skin. It seems to be a mutation and has been found with typical *P. corneus*, though many of its occurrences to-day are due to introduction by dealers ; e.g. the Apostles' Pool at Chipperfield, Herts (Stratton, 1945).

In October 1949 I visited Cross Oak Pond. It had obviously been dry during the summer, but then held several inches of what was probably surface drainage water. When full it would be about 3 feet deep in the middle. There were many dead shells of *P. corneus* on the dry bottom and in the water was a fair number of live snails. Of these about half were red-bodied and the rest black-bodied. *Viviparus fasciatus* (Müller) was also present in small numbers and many *Planorbis vortex* (L.) were crawling about on the grass in the water and on the surface.

A small sample of each form of *P. corneus* was taken. The animals were removed, care being taken to keep the shells separate. These were afterwards compared with each other and with Chipperfield shells. These latter had been found to have a reddish tinge and to be recognizably distinct from typical *P. corneus*. The Cross Oak var. *rubra* were similar in almost every way to the Chipperfield shells. The shells of the black-bodied snails from Cross Oak were so like the var. *rubra* shells that, had they been mixed with them, it would have been difficult to separate them. There is no reason to suppose that typical *P. corneus* has been introduced into Cross Oak since 1927, and it therefore seems possible that these black-bodied snails are a reverse mutation or " reversion to type ".

REFERENCES.

OLDHAM, C., 1928. Albinistic varieties of *Planorbis corneus* (L.). *Proc. Malac. Soc.* **18**, 42–44.

STRATTON, L. W., 1945. *Planorbis corneus* in Herts. *J. Conchol.* **22**, 172.

THE ALLEGED OCCURRENCE OF *HELIX ASPERSA* MÜLLER IN KITCHEN MIDDENS IN CHESHIRE.

By NORA FISHER MCMILLAN.

(*Read before the Society, 22 April 1950.*)

TAYLOR (1910, 252), writing of *Helix aspersa*, makes the following statement : " In Cheshire, Mr. B. B. Woodward has recorded its presence in deposits resembling ' kitchen-middens ', formerly on the shores of the river Mersey, but now about a mile therefrom." A more circumstantial account is given by Cuthbert Collingwood (1863, 113), a keen Liverpool naturalist : " It may be interesting to mention in this place that my friend Mr. I. Byerley, of Seacombe, has met with remains on the shores of the Mersey, which appear to resemble the deposits known as *kitchen middens*. He informs me that strata of shells exist at Wallasey, and in the sandhills along the shore, between Leasowe and Hoylake, which seem to resemble, on a small scale, the collections noticed by Mr. Lubbock, under the name of ' shell mounds ', in Scotland, and of ' Kjokenmoddings ' in Denmark. On going down the hill, just before entering Wallasey village, there is a bank, which may be 20 feet or more high, on the right hand side : two-thirds of its height is composed of sandstone, above which is a covering of earth from 4–6 feet in thickness ; between the latter and the sandstone a stratum of mussel-shells, about 8 inches thick, may be seen. The shells are partly whole and partly broken ; all, of course, are free from epidermis. . . . This stratum appears to have no other species of seashell intermingled : the terminal whorl and apex of a univalve, however, was just perceptible, which, on careful removal from the matrix, proved to be *Helix aspersa*. This bed is about a mile from the present sea-shore."

Later, the eminent geologist G. H. Morton visited the site, and after careful examination came to the conclusion that the deposit was " of quite recent date, and of no geological importance " (Morton, 1865).

I have failed to find any further reference to the occurrence of *H. aspersa* fossil in Cheshire, and it is clear that no pre-Roman age can be claimed for the Wallasey record.

REFERENCES.

COLLINGWOOD, C., 1863. The ancient fauna of Lancashire and Cheshire. *Proc. Lit. & Phil. Soc. Liverpool* **17,** 104–128.

MORTON, G. H., 1865. The recent shell-bed at Wallasey. *Proc. Liverpool Geol. Soc.* for 1864–65, 26–27.

TAYLOR, J. W., 1910. *Monograph of the Land and Freshwater Mollusca of the British Isles* **3,** part 17.

THE RESISTANCE OF *LITTORINA SAXATILIS* (OLIVI) TO LOWERED SALINITY.

By NORA FISHER MCMILLAN.

(*Read before the Society, 22 April 1950.*)

MATERIAL for this small experiment was collected on 28 January 1936 from boulders near H.W.M. at Greenisland, on the Antrim shore of Belfast Lough, N. Ireland. Twenty-seven specimens were taken, all of a rather large, smooth-shelled, yellowish-white form referable to the subspecies *rudis* (Maton). The winkles were kept in a shady room where the day temperature remained about 58° F. (lower at night) and were fed on *Ulva lactuca.* Every fifth day the animals were transferred to progressively less saline mixtures of tap water and seawater.

28 Jan. : all in seawater, and normally active.
30 Jan. : transferred to 3 parts seawater : 1 part fresh water :—all active.
3 Feb. : transferred to 3 parts seawater : 2 parts fresh water :—all active.
8 Feb. : transferred to equal parts seawater and fresh water :—19 active.
11 Feb. : transferred to 3 parts seawater : 4 parts fresh water :—16 active.
15 Feb. : transferred to 3 parts seawater : 5 parts fresh water :—9 active.
19 Feb. : transferred to 3 parts seawater : 6 parts fresh water :—6 active.
25 Feb. : all dead except one.

The seawater used was obtained off the Bar at the mouth of the Mersey and, as the salinity is rather lower than that of "normal" seawater, Herdman and Dawson's (1902) figure of 32·61 promille for the salinity of a station a mile north of the Bar lightship has been taken as the salinity of the seawater used in this experiment. On this basis, the animals died in a mixture of one part seawater to two parts fresh water, i.e. in a salinity of approximately 10·9 promille, but tolerated salinities down to and including 12·2 promille.

One would expect these winkles, living under purely marine conditions, although near the top of the tidal zone, to have less resistance to low salinities than the salt-marsh form *L. saxatilis tenebrosa* (Montagu), and this appears to be the case. The researches of Nicol (1936) on the fauna of the brackish lochs of North Uist show that there the minimum salinity in which subspecies *tenebrosa* occurs is 10–11 promille, and in the Randersfjord 5–6 promille.

REFERENCES.

HERDMAN, W. A., & DAWSON, R. A., 1902. Fishes and fisheries of the Irish Sea. *Lancs. Sea-fish. Mem.* no. 2.

NICOL, E. A. T., 1936. The brackish-water lochs of North Uist. *Proc. Roy. Soc. Edin.* **56**, 169–195.

ADDITIONAL NOTES ON JOSEPH WILCOCK.

By NORA FISHER McMILLAN.

(*Read before the Society, 22 April 1950.*)

SINCE Mr. Bayford and I (1944) published our account of Joseph Wilcock, some further information has come to our notice, especially regarding his book *Illustrations of our British Unionidae.* The late Dr. Collinge wrote in 1944 to tell me that G. Sheriff Tye, of Birmingham, possessed a bound copy of " a collection of drawings with notes by Wilcock. It was bound in thick blue paper covers ", and that Nelson also had a copy of the *Illustrations.* Tye's collection and probably his books also were sold and dispersed after his death, and the Wilcock item has been lost to sight. Dr. Collinge suggested that Nelson's copy might have gone with his collection to Leeds University, but inquiries made of the University Librarian in 1942 showed that there was no copy of Wilcock's book in either the University or the City Library. The copy from the library of Mr. E. R. Sykes is now in the possession of Mr. J. R. le B. Tomlin.

Wilcock was a friend of George Roberts of Lofthouse, and supplied numerous records of non-marine Mollusca, as well as plants, to Roberts' book (1882, 1885). It may also be noted that Bourguignat named a *Unio* after Wilcock, *U. wilcocki.*

REFERENCES.

BAYFORD, E. G., & McMILLAN, N. F., 1944. Joseph Wilcock and his *Illustrations of our British Unionidae. J. Conchol.* **22**, 83–87.

ROBERTS, G., 1882 (vol. 1), 1885 (vol. 2). *The Topography and Natural History of Lofthouse and its neighbourhood : with the Diary of a Naturalist and Rural Notes.*

***Succinea putris* (L.) parasitized by *Leucochloridium*.**—I am informed by Dr. W. J. Rees that he is not aware of any published record of *Leucochloridium paradoxum*, the sporocyst phase of the trematode *Distomum paradoxum*, in this country, although the mature fluke is frequent in certain birds. My discovery of *Succinea putris* (L.) infected with this parasite at Wheatfen Broad, Surlingham, Norfolk, 3 August 1939, is therefore worth placing on record. Mr. E. A. Ellis found infected *S. putris* there in July and August 1947 and, being more alive to the interest of this observation, published a note thereon in *Trans. Norfolk & Norwich Nat. Soc.* **16**, 329.

A. E. ELLIS.

(*Read before the Society, 22 April 1950.*)

GROWTH STAGES OF *CYCLOPE NERITEA* (L.).

By B. S. Kisch.

[Plate 4]

(*Read before the Society, 18 March 1950.*)

Cyclope [= *Cyclonassa*] *neritea* (L.) is a well-known Mediterranean species which occurs also on the Basque coast, in the littoral zone. At Socoa, near St. Jean-de-Luz, numbers may be seen crawling quite rapidly over the surface of the sand in shallow water, particularly when the tide is flowing.

In young specimens of *C. neritea* the spire is prominent, composed of three whorls, and the body-whorl is almost globular. As the animal grows the spire appears gradually to flatten out and the body-whorl becomes wide and depressed, the outline of the shell becoming obliquely suborbicular (plate 4, figs. 1–6).

In the adult shell the apex is usually quite smooth (plate 4, fig. 8), but occasionally the point of the spire remains exserted (plate 4, fig. 7). This feature is illustrated by Bucquoy & Dautzenberg (1882, pl. 12, fig. 21). The figures published by Kobelt (1887, pl. 28, figs. 16–22) all depict the normal adult shell with flattened spire, and I am not aware of any published figures showing the successive stages in the growth of the shell.

I am greatly indebted to the Rev. R. A. Ellis for his kindness in taking the photographs reproduced on plate 4.

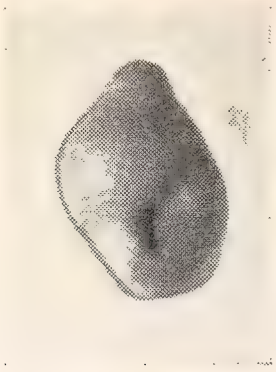
References.

Bucquoy, E., & Dautzenberg, P., 1882. *Les Mollusques marins du Roussillon.* Paris.

Kobelt, W., 1887. *Iconographie der schalentragenden europäischen Meeresconchylien* **1**. Cassel.

Explanation of Plate 4.

Cyclope neritea (L.) : figs. 1, 2 : × 7 ; figs. 3–6 : × 6 ; figs. 7, 8 : × 3 (approx.). Figs. 5 and 6 are slightly different aspects of the same shell.



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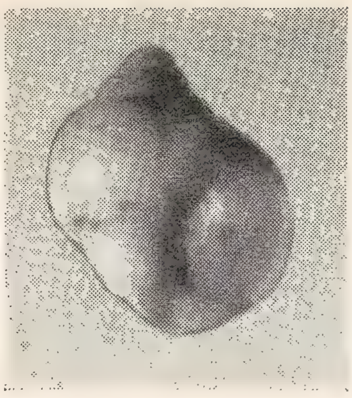

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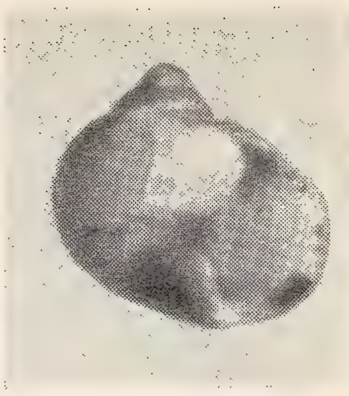

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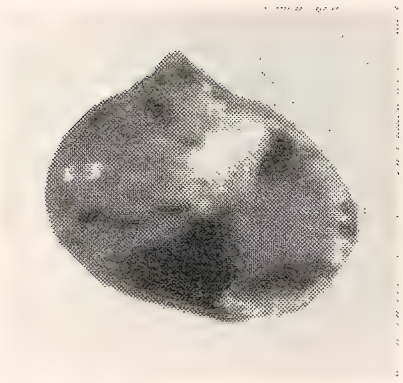

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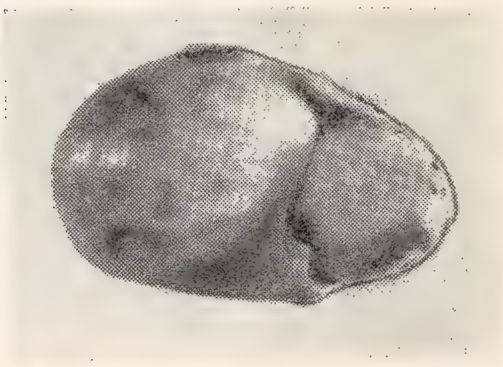

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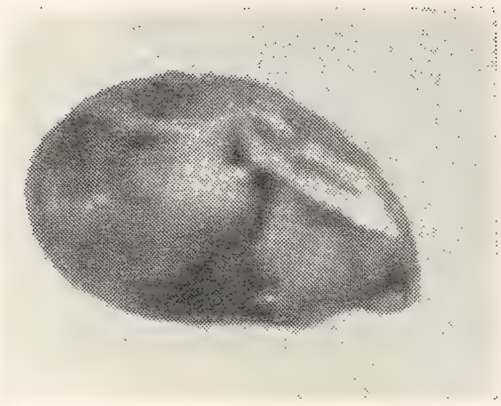

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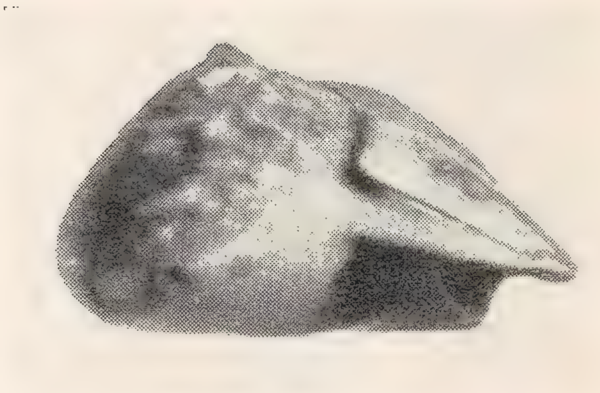

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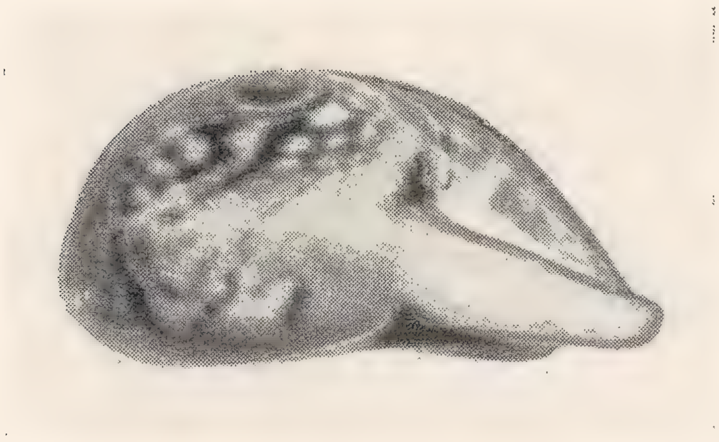

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Cyclope neritea (L.).

ODOSTOMIA EULIMOIDES HANLEY ON *CHLAMYS VARIA* (L.).

By B. S. Kisch.

(*Read before the Society, 18 March 1950.*)

On examining a small consignment of *Chlamys varia* (L.) from La Rochelle I found on the " ears " of two of them a living specimen of *Odostomia eulimoides* Hanley. Fretter and Graham (1949) have established that " Pyramidellids are ectoparasites. Each species feeds on a particular species of host, usually a tubicolous polychaete or a lamellibranch mollusc, obtaining attachment to the body by means of the oral sucker, piercing the body wall with the buccal stylet and sucking blood, and perhaps tissue débris, by means of the buccal pump ".

Jeffreys (1867, 125) gives the habitat of *O. eulimoides* as " Chiefly (if not only) on the ears of *Pecten opercularis* and *P. maximus*, in the coralline zone ". Dr. Vera Fretter, who kindly verified the determination of my specimens, informs me that she knows of no record of the occurrence of *O. eulimoides* on *C. varia*.

References.

Fretter, V., and Graham, A., 1949. The structure and mode of life of the Pyramidellidae, parasitic Opisthobranchs. *J. Mar. Biol. Assoc.* **28**, 493–532.

Jeffreys, J. G., 1867. *British Conchology* **4**.

A NEW SPECIES OF *POMACEA* (*LIMNOPOMUS*) FROM VENEZUELA.

By T. Pain.

(*Read before the Society, 18 March 1950.*)

Pomacea (Limnopomus) meridaensis n. sp.

Ampullaria interrupta Alderson, 1924; 1925, 52, pl. 11, fig. 7 (*non* Sowerby, 1909).

Pomacea (*Limnopomus*) *interrupta* Baker, 1930, 9.

Shell of medium size, oblong, conoid, very narrowly umbilicate, thick and solid; surface heavily malleated with coarse and rather prominent growth lines. Whorls 6, slantingly convex, suture simple. Spire moderately raised, about one-third the total height of the shell. Aperture oblong, ovate, lip thickened, corrugated and strongly expanded, but not reflected. Columellar lip heavy, with a thin but well marked parietal callus. Colour olive yellow, with narrow dark bands only marked distinctly on the front; spire reddish chestnut; aperture livid reddish in the depths, lighter behind, lip bright orange yellow. Operculum thin, horny, outer surface concave, marked by fine and closely spaced growth lines; muscle scar large and fairly prominent; colour uniform reddish brown.

Dimensions of holotype (Alderson, 1925, pl. 11, fig. 7): height 50 mm., width 40 mm., maximum height of aperture 34 mm., maximum width of aperture 22 mm.

The original series of some thirty specimens was received by Alderson with the locality " Merida, Venezuela ", which from personal knowledge of the collector he had every reason to accept as correct. The holotype and numerous paratypes in all stages of growth are in the Alderson collection in the possession of Lady Iliffe at Yattendon Court, to whom the author is deeply indebted for permission to examine Alderson's Pilidae and to describe this additional species.

In his original notes on these shells Alderson (1924) considered them to represent the adult state of the small shell described by Sowerby (1909, 361) as *Ampullaria interrupta* (type from the da Costa collection in the British Museum), which he considered to be an immature specimen. After careful examination of Sowerby's type specimen, together with a small series from his collection and further examples kindly furnished by Dr. J. Bequaert, I am convinced that *Pomacea interrupta* (Sowerby) represents what is perhaps best regarded as the Venezuelan form of *P. crassa* (Swainson, 1823, pl. 136) from British Guiana. I cannot agree with Alderson that Sowerby's type shell is in any way immature, in spite of the prettily spotted lip to which he drew particular attention, because this is not necessarily an indication of immaturity. I have shells of *P. crassa* which show similar markings and which are certainly fully developed. The lip in Sowerby's holotype is somewhat thickened, flatly expanded but not reflected. Larger examples I have seen are similar in this respect. Immature shells of most *Pomacea* have a very thin and straight edge to the outer lip, with no sign of thickening or reflection.

Further differences exist in the umbilicus, which in *P. interrupta* (Sowerby) and *P. crassa* (Swainson) is always completely closed. *P. meridaensis* on the other hand is narrowly umbilicate in all specimens examined. In typical *P. interrupta* the aperture is much higher and narrower in proportion to its width than in *P. meridaensis.* The latter also lacks the spotted varices present in most examples of *P. interrupta* and common also in large specimens of *P. columellaris* (Gould) from Peru. *P. meridaensis* resembles in general appearance the much larger *P. hollingsworthi* (Pain, 1946) from Columbia, but is easily distinguished from this by its far narrower umbilicus, more acute spire and broadly expanded lip. In common with other solid and often imperforate species from the highland areas of northern South America, *P. meridaensis* represents a typical example of Dall's (1904) group *Limnopomus*, said to be peculiar to the swiftly flowing mountain streams and torrents of Equador, Venezuela, Columbia and Peru.

REFERENCES.

ALDERSON, E. G., 1924. Note on *Ampullaria interrupta*, Sow. *Proc. Malac. Soc.* **16**, 50–52, text-figure.

ALDERSON, E. G., 1925. *Studies in Ampullaria.*

BAKER, H. B., 1930. The Mollusca collected by the University of Michigan-Williamson Expedition in Venezuela, part 6. *Occ. Papers Mus. Zool., Univ. Michigan* **210**.

Dall, W. H., 1904. Notes on the genus Ampullaria. *J. Conchol.* **11**, 50–55.
Pain, T., 1946. Two new species of *Pila* (= *Ampullaria*) from South America. *Proc. Malac. Soc.* **26**, 180–181, pl. 6.
Sowerby, G. B., 1909. Notes on the family Ampullariidae (etc.). *Proc. Malac. Soc.* **8**, 345–362.
Swainson, W., 1823. *Zoological Illustrations,* 1st series, **3**.

THE SPERMATOPHORE OF *MILAX SOWERBII* (FÉRUSSAC).

By H. E. Quick.

(*Read before the Society, 20 May 1950.*)

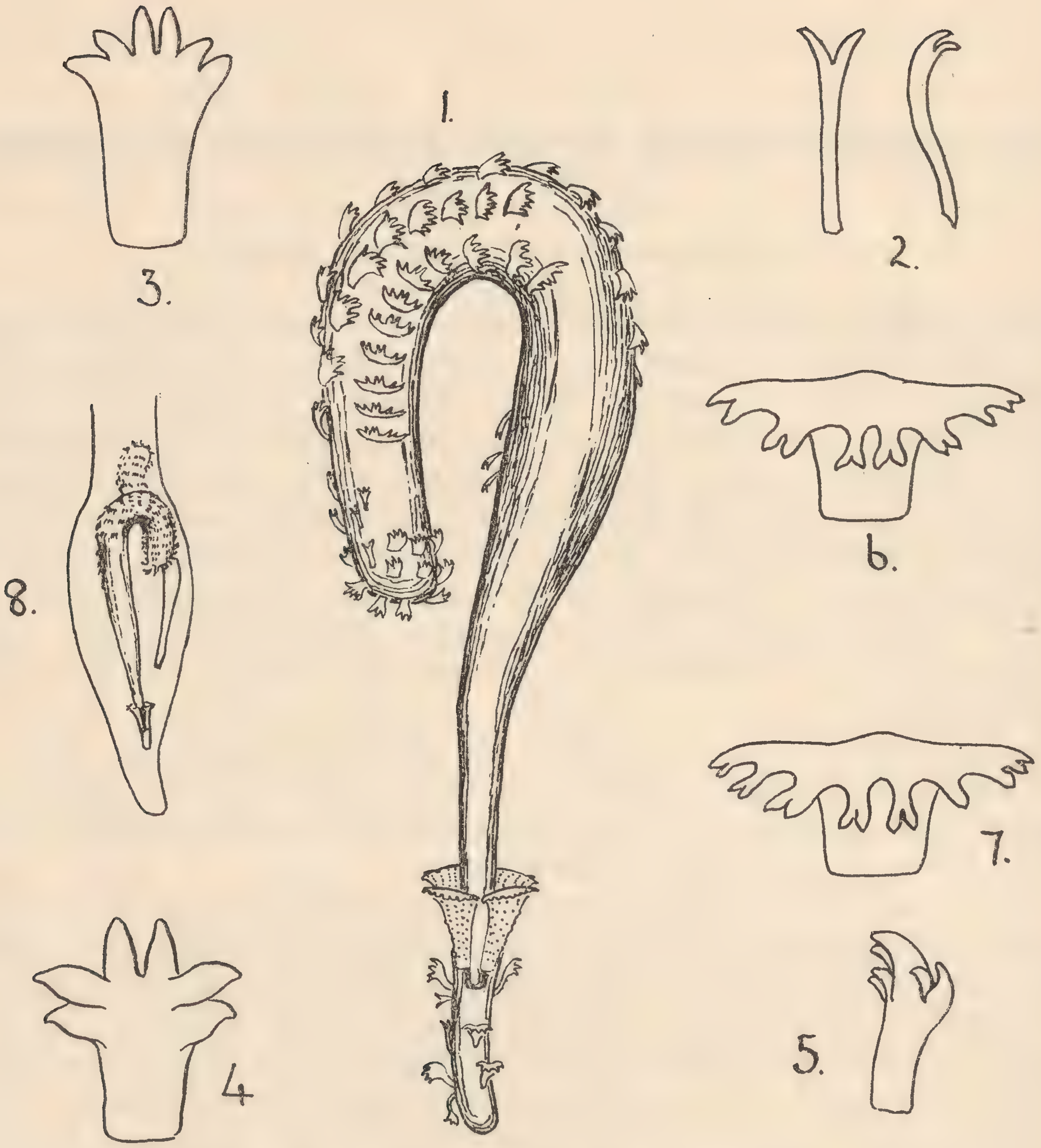
The apex of the spermatophore of *Milax sowerbii* at the narrower smooth end, when found by chance in the spermatheca, has a blunt almost squarely truncated end, as figured by Watson (*J. Conchol.* **19**, 82) and other authors. If, however, it is removed from the spermatheca immediately after coitus, the end is seen to be capped by a conical structure with a rounded apex, about 3 millimetres long, like a candle extinguisher over a candle. At its base there is a circlet of four leaflets, the reflexed ends of which are serrated, while their sides bear longitudinal rows of minute granules. The terminal part bears seven or eight spinose processes similar to, but smaller than, those of the main part of the spermatophore (fig. 1).

The spermatophore travels from the partner's epiphallus and penis with the capped end in advance, so this is found in the apex of the spermatheca, although the slope of the spinose processes would seem to hinder rather than facilitate its progress.

On the main portion of the spermatophore at the larger end the spinose processes are crowded and end in thick blunt spines (figs. 3, 4 and 5). Near this end there are a few slender bifid spines (fig. 2). The remainder of the spinose portion of the spermatophore carries about three rows of spinose processes in which the terminal branching varies somewhat, but usually they end in from twelve to fourteen points (figs. 6 and 7). Sometimes there are a few slender bifid spines, like those near the blunt end, on the concave side of the loop.

Occasionally two spermatophores are found in the spermatheca, of which one may be capped and the other not (fig. 8). Whether they are derived successively during one coitus or from different partners is not known. In this connection it may be noted that in *Arion* the spermatophore seems to be formed very shortly before or even in the early stages of mating, and seeing that in *Milax* coitus lasts a long time, it seems possible that two spermatophores could be derived from the same mating.

On examination from twenty-four to forty-eight hours after mating the spermatophore is seen to end, as usually figured, without the cap, which has come off and disintegrated, and only fragmentary traces can sometimes be found in the spermathecal fluid.



FIGS. 1–8.—Spermatophore of *Milax sowerbii*.

1. Spermatophore with cap (× 8).
2. Bifid spines near larger end of spermatophore (× 66).
3, 4, 5. Thick blunt processes from the larger end of spermatophore (× 66).
6, 7. Spinose process from the main body of spermatophore (× 66).
8. Spermatheca with two spermatophores, one with and one without a cap (× $2\frac{1}{3}$).

MOLLUSCA OF A SEWAGE WORKS.

By W. D. FISHER.

(*Read before the Society, 22 April 1950.*)

IN 1948 the Leeds Naturalists' Club and Scientific Association arranged a lecture by Dr. Llewellyn Lloyd, of the Department of Zoology, Leeds University, on the succession of life through the year on sewage filter beds, followed by a visit to the Leeds Corporation sewage works at Knostrop. Dr. Lloyd did not refer to the presence of Mollusca on the filter beds, but on the visit to the works I was struck by the occurrence of *Lymnaea peregra* (Müller) on many of the stones that form a medium for the beds. In consequence of this observation, Dr. Lloyd agreed to give a talk on his investigations on the Leeds sewage works to the Yorkshire Branch of the Conchological Society, to be followed by a visit under his guidance. This took place in September 1949, and what follows is a record of this meeting and excursion.

The Knostrop sewage works deal with the city's effluent, both industrial and domestic, which in this case are not separated. Before the delivery of the effluent to the filter beds it passes through screens to break up or remove any solids, whence the fluid passes into large tanks which slow down the flow and allow sediments to settle. After this there follows a further series of tanks where calcium hydroxide is added to neutralize the acids which come in from the many industrial chemical processes. After this settling and lime treatment the water is passed on to the filter beds, which cover about 30 acres. Each group is 160 yards long and 20 yards wide, and the filters are 6 feet deep. The sewage is passed to a set of four beds by means of four distributors, which spray the fluid over the filters and rotate slowly, taking about 20 minutes to complete each cycle. It must be explained that the beds are not tanks, but walled channels filled with stones graded to pass through a 2 inch mesh. Alongside each block of filter beds runs an aeration channel with ducts leading into the filter chamber.

After the fluid has passed through the filter beds it goes into humus tanks, where the solids produced by the " grazing " organisms are allowed to settle. The final effluent is then conducted from the works into the river Aire. Most of the purification of the sewage takes place in the filter beds, and the amount of oxygen dissolved in the water is the measure of the success of the purification. Various algae grow on the stones composing the filters and play a large part in dealing with the sewage, but if the growth of algae went unchecked they would form mats preventing the flow of water. These algae are attacked by many animals, and it is to the study of these organisms and their succession through the year that Dr. Lloyd and other zoologists have given great attention.

Leaving aside the oligochaete worms and larvae of various kinds of flies which swarm successively throughout the year, I come to the Mollusca. We took specimens of *Agriolimax reticulatus* (Müller), which Dr. Lloyd said sometimes swarms on the surface and was a great nuisance at first, as numbers of the slugs used to enter the jars used for trapping flies and eat the paper cone which was a component of the trap, but this trouble was remedied by treating the paper with a weak solution of copper sulphate. Turning over the stones that do the filtering we found large quantities of *Lymnaea peregra*, all small (7–8 mm.) ; the shells were thin and rather delicate but not in any way malformed or corroded ; there was a high proportion of empty shells. We did not spend much time examining the filter beds and no other species was observed.

I have already mentioned the aeration channels that serve to allow air to pass into the bottom of the beds ; these under certain conditions pass a surge of liquid from the beds. At some points in the channels there were deposits of empty shells. Miss Morehouse scraped up some of this material, which proved to be composed mainly of shells of *Lymnaea peregra*, but shells of *Oxychilus cellarius* (Müller) were also quite numerous and there were a few of *Lymnaea truncatula* (Müller).

The final channels which take the purified water from the humus tanks to the river have to be dredged fairly frequently, since vast numbers of shells, some empty and some still containing the " animal ", tend to choke these conduits, so at each outlet we found heaps of shells amounting to several bushels. From time to time these mounds of shells are shovelled into carts and tipped out on waste ground in the sewage works. I endeavoured to make a very rough estimate of the numbers of shells that these heaps contained and collected a box full from one of the heaps. The capacity of the box was about 7 cubic inches, and it held 677 shells of *Lymnaea peregra* and four of *L. truncatula*, with no other species. The *L. peregra* shells were quite shapely and very uniform in size, ranging from 3 to 10 mm., by far the largest number being 6 to 8 mm. in height. Each mound I computed to contain some quarter of a million shells, and in the four or five heaps seen there would be at least a million. No shells of *Oxychilus cellarius* were seen in these heaps, which is not surprising since they came out of channels of flowing water which had passed through the humus tanks.

I think it must be considered that filter beds form a very specialized habitat for these Mollusca, and it may well be that colonization by these animals is a gradual process and necessitates some degree of adaptation to the special conditions. Dr. Lloyd when first making his study of the life in the filter beds took specimens of snails which he says were identified by conchologists as *Lymnaea glabra* (Müller), but we found no examples of this species. If the identification was correct, some alteration in the conditions may have caused it to die out.

Various factors specially relating to molluscan life in sewage works will now be considered. There is, of course, an abundant supply of water likely to contain a constant and high proportion of material suitable for the support of a vast molluscan fauna, but the number of species will be limited to those which can adapt themselves to the very special conditions. The stones of which the beds are composed are fairly tightly packed, and any rigidly encased animal like a snail will be prevented from moving freely about if it grows too large to pass through the interstices (about 3 to 6 mm.) between the stones. The animal must be able to tolerate the drenching at about 20 minute intervals occasioned by the travelling distributors. If it is terrestrial, it must be able to survive the periodic wetting and have access to air ; if aquatic, it must be able to live for a great part of its time in air in the intervals between the brief shower-baths.

The filter beds support an enormous population and, even though the water that comes to them must be charged with much that they can consume, competition must still be intense. Against this can be set the fact that the fluid being dealt with does not subject the animals to such extremes of temperature as are experienced under normal conditions, so their season for growing and breeding will be extended ; frost is practically unknown. The oxygen content of the fluid delivered to the filter beds is very low and the water is contaminated to a high degree with acids, salts, alkalis, soaps, oils, both mineral and natural, etc., but owing to the addition of lime during the earlier treatment of the sewage sufficient oxygen for snail life will always be present.

In conclusion it may be said that I have not been able to follow up the various problems presented. For instance, is the small size of the *Lymnaea peregra* a permanent adaptation brought about by selection acting over many rapidly succeeding generations in the filter beds ? Has the anatomy of the snails undergone any change ? What is the cause of the very high rate of mortality ? These and other questions await an answer, but the above observations are sufficient to demonstrate that even such an apparently unpromising, and it must be confessed somewhat repellent, environment as a sewage farm affords plenty of scope for the student of molluscan ecology.

The type species of *Testacella*.—*Testacellus maugei* Férussac, which is assumed to be identical with *Testacella haliotoides* Lamarck (*nomen nudum*), is usually cited as the type species of *Testacella*. As *T. haliotoides* was undescribed, *Testacella* Lamarck, Jan. 1801 (like *Testacella* Cuvier, 1800), is *nomen nudum*, for this was the only species cited by Lamarck (*Syst. Anim. sans Vert. :* 96). The earliest publication of the generic name *Testacella* valid in nomenclature is Draparnaud, July 1801 (*Tabl. Moll. France :* 99), of which the type species by monotypy is *T. haliotidea* Draparnaud.

A. E. Ellis.

(*Read before the Society, 22 April 1950.*)

LACINIARIA BIPLICATA (MONTAGU) IN SOMERSET.

By A. H. Turner, F.R.E.S.

(*Read before the Society, 18 February 1950.*)

On moving from Norfolk to Somerset in 1945 my interest in entomology took a new lease of life, in searching the new haunts for Lepidoptera and Coleoptera. When hunting under trees and in other suitable places for pupae one inevitably found various kinds of snails, which were placed in boxes and left to be examined when opportunity offered. It was whilst working sallows (*Salix caprea* L.) in the late summer of 1945 (and subsequently) that I came across some Clausiliidae, which were later identified as *Laciniaria biplicata* (Montagu).

My conchological literature was limited to Forbes and Hanley, Rimmer, and Adams, from which one learnt that *L. biplicata* had been recorded from the neighbourhood of Bristol, and at Easton Grey (Montagu's original locality) and Clarendon in Wiltshire, in addition to the London area. In view of this, I retained all those specimens which turned up at different times. All the snails were found more or less accidentally while "bug-hunting" in one small area, alongside a green cattle drove leading up to (what then was) a large oak wood, in the parish of Bickenhall. During the last two years this wood has been completely felled, and the removal of the trees by tractors has made the area and the drove resemble the Flanders battlefields in 1917. As *L. biplicata* was by no means common in this area, it seems probable that those which have been found may be outliers of some larger colony in the vicinity.

In 1948 I had some correspondence with Mr. A. G. Davis and exchanged shells and fossils with him. Among the shells sent him were *L. biplicata*, and he pointed out their great rarity in the west of England. Mr. Davis subsequently referred me to E. W. Swanton's *Mollusca of Somerset*, 1912, in which the author writes of this species :—

> In Somerset it is apparently confined to the north-western district.
>
> Leigh Woods ; *W. W. Stoddart*, in Leipner's list. (Quoted, with a query, by Cundall.)
>
> "Stated by Miller to exist in the neighbourhood of Bristol" ; Forbes and Hanley.
>
> Two specimens (living) were found together in a cranny in a wooden gate post at Sidcot, in Winscombe parish, in 1865 ; *F. A. Knight*.

Now Sidcot is approximately 25 miles from Bickenhall, and it may well be that *L. biplicata* occurs in other isolated and unworked parts of the county.

At the suggestion of Mr. Davis, I reported the find to Mr. A. E. Ellis, who confirmed the identification and exhibited specimens I sent him at a meeting of the Conchological Society, 19 November 1949 ; these have been presented to the British Museum (Natural History). I wish to express my thanks to Mr. Davis for all the information he has given me ; without his good offices it is probable that the rediscovery of this rare snail in Somerset would have remained unrecorded.

EDITORIAL NOTES.

DR. N. HJ. ODHNER (*Vidensk. Medd. fra. Dansk naturh. Foren.* **3**, 1949, 217) records the species of *Succinea* called *S. elegans* by Ellis (*British Snails*, 1926, 137) and Quick (*Proc. Malac. Soc.* **20**, 1933, 299) from Sweden and Denmark. He points out that this cannot, however, be the *S. elegans* of Risso, which is probably conspecific with *S. pfeifferi* Rossmässler, but that it agrees anatomically with topotypes of *S. pfeifferi* var. *sarsi* Esmark, 1886, and concludes that the species we now know as *S. elegans*, " as far as can be decided at present, has to take the name of *S. sarsi* Esmark as valid."

In an important paper on " The Structure and Mode of Life of the Pyramidellidae " (*J. Mar. Biol. Assoc.* **28**, 1949, 493–532) Dr. Vera Fretter and Professor A. Graham reach the conclusion, from a consideration of the structure and reproductive habits of the group, that these Gastropods are parasitic Opisthobranchs ; they have hitherto been classified as Prosobranchia.

A paper by Ursula M. Grigg on " The Occurrence of British *Aplysia* " (*J. Mar. Biol. Assoc.* **28**, 1949, 795–805, pl. 1, 2) records the discovery of a new British species, *A. limacina* L., in Salcombe estuary, South Devon. The distribution of the other two British species, *A. punctata* Cuvier and *A. depilans* L., is given in detail, with a key to the species and photographs of the living animals.

The collection of the late A. S. Kennard, comprising recent and fossil non-marine Mollusca, together with his manuscript notebooks, has been acquired by the British Museum (Natural History), and is deposited in the Department of Geology.

It was with great gratification that we learnt of the appointment of the President of the Society, Mr. G. L. Wilkins, to a post in the Department of Zoology at the British Museum (Natural History), where he is assisting Dr. W. J. Rees with the Mollusca section.

G. Mandahl-Barth, *Bløddyr*, iii, *Ferskvandsbløddyr*, Copenhagen, 1949 (Danmarks Fauna, volume **54**) : the third volume on Mollusca in this series deals with the freshwater species, illustrated by good line-drawings of the shells. A feature of the book is a section on the egg-capsules, and there is an appendix of additions to Steenberg's earlier volume on the land snails.

In connection with a book on the Birds of the London area, which is in preparation under the auspices of the London Natural History Society, information is sought on the Mollusca of the reservoirs in the neighbourhood of London, e.g. those at Littleton, Staines, Hampton, Kempton, Molesey, Barn Elms, Lonsdale Road, Elstree, Ruislip and Welsh Harp. The purposes of the inquiry are (i) to find out whether there are any food factors which might influence the presence of ducks at one group of reservoirs in greater numbers than at another; (ii) to find out what connection, if any, exists between the presence of gulls at the reservoirs, and along the Thames at low tide, and the Mollusca found in such places, on some of which they undoubtedly feed. Anyone who has any information on this subject, or is prepared to investigate the problem, is asked to communicate with Mr. R. C. Homes, 62d Albemarle Road, Beckenham, Kent.

Cheshire and North Wales Natural History, volume **3**, now in the press, includes a section on non-marine Mollusca by Mrs. N. F. McMillan and Dr. J. O'N. Millott. The price will be 12*s*. 6*d*. in stiff paper covers and 18*s*. in cloth binding, obtainable from Mr. S. Gordon Smith, Estyn, Boughton, Chester.

The articles dealing with Mollusca in the new edition of *Chambers's Encyclopaedia*, recently published, have all been written by Mr. R. Winckworth, with illustrations, including a beautiful coloured plate, by Mr. G. L. Wilkins.

The Royal Swedish Academy of Science at their meeting on 12 April awarded the silver Linnean medal to Dr. Hans Schlesch.

REVIEW.

The Sea and its Mysteries. JOHN S. COLMAN. Pp. 285; coloured frontispiece and 16 half-tone plates; 36 text-figures; folding map. London: G. Bell and Sons, Ltd., 1950. Price 12*s*. 6*d*. net.

THIS is a book which can be warmly recommended to all interested in the sea and its inhabitants, presenting, as it does, an up-to-date account of oceanography in an eminently readable form. The first three chapters deal with the physical and chemical characters of the sea, the other nine being concerned with marine life and an outline of modern methods and trends of research. Although a popular work surveying so vast a field within so small a compass could not be expected to deal in any detail with Mollusca or any other group, it is axiomatic that a general knowledge of the sea must form an essential basis for the scientific study of all that therein is, and is an indispensable equipment of the marine biologist in whatever group he may specialize. It is regrettable that the discredited theory that birds possess a magnetic sense should have been given further currency (see *Proc. Linn. Soc.* **160**, 85), but that this should be the only passage in the book which the reviewer can find to criticize is in itself a commendation. The author is to be congratulated on producing such a felicitous combination of instruction and entertainment. He writes with wide practical experience of his fascinating subject and infectious enthusiasm for the great and wide sea, that through the ages has stirred the mind of man with wonder and, for all the spectacular progress of science, forever flaunts its challenge of unfathomed mysteries.

OBITUARY

W. THURGOOD, 1876–1949.

WILLIAM THURGOOD, the son of Thomas Thurgood of Baldock and Mary Isobel (*née* Stead) of York, was born in Birkenhead on 9 May 1876 and died at Leeds on 4 December 1949. He had been ailing for some time and was in hospital for two months, where he died. He left Birkenhead when an infant and lived in York for many years, where he entered the service of the North Eastern Railway Company (later absorbed into the L.N.E.R. Company) at the age of 14 years. First at York, he was subsequently train master at Middlesbrough for several years and finally yard master, station master and goods agent at Blaydon-on-Tyne for some years. He retired from there in 1936 and came to live in Leeds.

For several years Thurgood was honorary district organizer for the East Pennine section of the British Thunderstorm Survey. He also took a great interest in male voice choirs and was for many years conductor of the York Male Voice Choir and the York Glee and Madrigal Society.

Thurgood had been keenly interested in land and freshwater Mollusca since the age of 12 years, and was for many years a member of the York Field Naturalists' Club and later of the Wallis Club, Newcastle-on-Tyne ; on coming to Leeds he joined the Leeds Naturalists' Club, of which he was President in 1941, and the Yorkshire Naturalists' Union. He was elected a member of the Conchological Society in 1938 ; he was Recorder for the Yorkshire Branch and in 1948 became Hon. Librarian and Curator of the Society. His interests were general and he never specialized.

When sorting back numbers of the *Journal* in the Society's library at Leeds, his attention was attracted by two articles on the Mollusca of Grange-over-Sands, one by Standen, 1898, and the other by Jackson & Moore, 1904. Mrs. Thurgood and he decided to visit this area in 1948, and the results of their collecting were recorded in the *Journal* (**23**, 1949, 48).

A further paper by Thurgood was published in the *Journal* (**23**, 1949, 73), on " The Mollusca of the Leeds Naturalists' Club and Scientific Association's Area," embodying his presidential address to the Club. He died ten days before its publication.

Thurgood had much to do with the transference of the Conchological Society's library and collections from the Manchester Museum to the Leeds Museum on my retirement, and spent considerable time on its arrangement in the new quarters. By his death the Society has suffered the loss of a devoted and conscientious officer, whose place it will not be easy to fill.

I am much indebted to Mrs. Thurgood for the biographical particulars incorporated in this obituary.

J. WILFRID JACKSON.

A. G. STUBBS, 1871–1950.

ARTHUR GOODWIN STUBBS was born at Nottingham on 10 January 1871 and died on 23 February 1950. He was the elder son of Arthur Stubbs, of Sherwood Rise, Nottingham, and was educated at Haileybury and Jesus College, Cambridge. He contrived to turn his interest in botany to practical account by going into business as a nursery gardener. He married in 1895, and had one daughter, two grandchildren and one great-grandchild.

Stubbs was captain of his school and college cricket teams and a first class lawn tennis player of Wimbledon standard ; he was also proficient at hockey, golf and billiards. In contrast to his athletic prowess he was a chess expert of international reputation, and contributed over 2,000 chess problems to various newspapers. This, however, did not exhaust his versatility, for Stubbs was gifted with a high degree of artistic talent, and was awarded the Grenfell Medal (silver and bronze) for about 20 years in succession by the Royal Horticultural Society for his water-colour paintings of flowers.

To his other interests and pursuits Stubbs added an enthusiasm for conchology, and his exquisite paintings of shells used to form one of the most popular exhibits at annual meetings of the Conchological Society. The more variable species of Helicidae particularly attracted him, and in the portrayal of their numerous mutations of colour and markings his delicate artistry found its most felicitous expression. His *Illustrated Index of British Freshwater Shells* was published by Taylor Brothers of Leeds in 1907, but some of the reproductions fail to do full justice to the accuracy of the original drawings. Stubbs was celebrated for his skill in cleaning even the most intractable shells, and his specimens never failed to evoke the admiration and envy of less accomplished conchologists. He had a pamphlet printed in 1900 for private circulation, entitled " Hints on cleaning the smaller transparent species of British Land Mollusca ".

Stubbs' collection and paintings of shells are now in the possession of Mr. David A. Richardson, who has kindly supplied most of the above particulars of his grandfather's life.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

692nd Meeting (Annual Meeting), held at the British Museum (Natural History), 10 December 1949.

Mr. A. E. Salisbury, Vice-President, in the chair.

Election of Scrutineers.

Mr. J. F. M. de Bartolomé and Mr. D. E. Brown were elected Scrutineers.

Election of Auditors.

Mr. C. P. Castell and Dr. W. J. Rees were elected Auditors for 1950.

Election of Member.

Miss Dorothy B. Gee, Somerville College, Oxford, was elected a member of the Society.

Member Deceased.

Mr. Salisbury announced the death of William Thurgood on 4 December, and paid a high tribute to his devoted work for the Society as Hon. Librarian and Curator.

Statement of Accounts.

The Hon. Treasurer made an interim report on the finances of the Society and it was resolved that the accounts up to the end of the year be published in the *Journal* when audited.

Votes of Thanks.

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permission to hold meetings in the Museum; to the authorities of the Leeds Museum for housing the Society's library and collections; and to Officers and Members of Council for their work on behalf of the Society.

Annual Reports.

The Reports of the Council and of the Recorders for Marine and Non-marine Mollusca were presented and adopted.

Election of Officers and Council.

The Officers and Council were declared elected as printed on the voting papers, with the exception of the late Mr. Thurgood, whose offices have not been filled, and Professor Hale Carpenter, who expressed a wish not to be re-elected to the Council (see page 97).

Exhibits.

Mr. D. E. Brown: *Subulina* cf. *striatella* (Rang) living in the Insect House at the Zoological Gardens, Regent's Park, London; varieties of *Cochlitoma zebra* (Bruguière).

Mr. A. G. Davis: "Frankeslides" of small shells, darts, clausia, etc.; a copy of *Musaeum Tradescantianum* by John Tradescant, 1656; shells of *Helix pomatia* L. which were found in quantity recently dead under conifers at Marden Park, Surrey, August and September 1949.

Mr. H. F. Jones: species of *Acavus* from Ceylon.

Mr. T. Pain: species of *Metorthalicus* from Peru, Equador and Colombia.

Dr. H. E. Quick: topotypes of some of O. F. Müller's species of land snails from Fredriksdahl and Fortunen, Denmark.

Mr. L. W. Stratton: land and freshwater shells from the neighbourhood of Buffalo, State of New York, U.S.A.

Annual Report of the Council.

Four ordinary meetings of the Society have been held during 1949 at the British Museum (Natural History) with fairly good attendance. Membership now stands at 160, comprising 2 honorary members and 158 ordinary and life members, an increase of 10 in the course of the year.

The Society has suffered the loss of several well-known members, whose obituary notices will be found in the *Journal*: C. H. Moore, R. H. Moses, E. Stainton, F. Taylor, W. Thurgood. Three of these deceased members have served as officers of the Society, and Mr. Thurgood was Curator and Librarian up to his death less than a week before the Annual Meeting.

Two numbers of the *Journal* have been published in 1949, namely volume **23,** number 2, 31 May, and number 3, 14 December.

Report of the North Staffordshire Branch.

During the past year no new records have been received. We are still active workers, but our district has already been so well explored that nothing unusual has come to our notice. Two large pools in the Longton area, which contained several interesting species of freshwater Mollusca, have been drained and filled in. As the water receded I obtained a good series of *Lymnaea stagnalis*; the shells were remarkably fragile.

B. BRYAN.

Recorder's Report: Non-marine Mollusca.

Cornwall West (1): *Hydrobia jenkinsi*, Penzance, Lamorna and Sennen; *Agriolimax caruanae*, Sennen Cove (first found in W. Cornwall by Charles Oldham, but not recorded in Census), A. E. Ellis.

Cornwall East (2): *Carychium minimum*, *C. tridentatum*, *Succinea pfeifferi*, *Columella edentula*, Mevagissey, A. Nilsson (*per* H. Schlesch).

Lundy Island (4a): *Arion ater* and var. *albolateralis*, *Limax maximus*, *Hygromia striolata*, *Helix aspersa*. The following species are also recorded in *Ilfracombe Fauna and Flora*, edited by M. G. Palmer (Exeter, 1946), but specimens have not been seen by the Recorder: *Arion subfuscus*, *Vitrina pellucida*, *Limax flavus*, *Agriolimax reticulatus*, *A. laevis*.

Somerset South (5): *Laciniaria biplicata*, Bickenhall, A. H. Turner.

Somerset North (6): *Pisidium pseudosphaerium*, Glastonbury, H. Overton, 1906 (det. A. W. Stelfox).

Wilts North (7): *Valvata cristata*, Devizes, C. D. Heginbothom, 1943; *Planorbis crista*, Bowood Lake, Calne, Dr. C. J. C. Siggers, 1942.

Wilts South (8): *Planorbis crista*, Potterne, C. D. Heginbothom; *Vertigo moulinsiana*, Fisherton Delamere, R. S. Newall, 1944; *Sphaerium transversum* (= *pallidum*), Kennet and Avon Canal near Devizes, Dr. C. J. C. Siggers, 1942 (boundary between v.c. 7 and 8).

Bedford (30): *Planorbis laevis*, Leighton Buzzard; *Zonitoides excavatus*, Bedford, B. Verdcourt, 1943.

Denbigh (50): *Agriolimax caruanae*, Old Colwyn, H. E. Quick.

Flint (41): *Planorbis complanatus* (= *fontanus*), Rhyl, I. T. Fleming.

Nottingham (56): *Milax gagates*, Kelham; *Pisidium personatum*, Southwell, G. W. Pitchford.

Roxburgh (80): *Hydrobia jenkinsi*, Hawick reservoir, A. J. Smith.

Aberdeen South (92): *Oxychilus draparnaldi* (= *lucidus*), *Milax gagates*, *Agriolimax caruanae*, *Limax flavus*, Aberdeen; *Hygromia striolata*, Ballater, Miss Aileen Forrest.

Cork Mid (146M): *Carychium tridentatum*, Inniscarra, W. E. R. Hackett, 1939.

Cork West (147): *Carychium tridentatum*, Goleen, W. E. R. Hackett, 1939.

Mr. Hugh Watson has kindly sent the following records for the slug provisionally referred to *Agriolimax caruanae* Pollonera (see *J. Conchol.* **22**, 54):

Hants South (11): Highcliffe-on-sea, H. Watson, 1932.

York Mid-West (64): Settle, A. E. Boycott and C. Oldham, 1935.

Durham (66): Darlington, B. R. Lucas, 1931 (*Trans. North. Nat. Union* **1**, 1934, 177).

Edinburgh (83): Edinburgh, R. Waterston, 1931.

An outstanding record is that of *Laciniaria biplicata* (Montagu) from Somerset. There are several old records for Somerset and Wiltshire, including Montagu's original locality at Easton Grey, and specimens collected by Bridgman at Clarendon (Jeffreys, *British Conchology* **1**, 283) are in Norwich Castle Museum, but the species has not been reported from further west than Surrey for many years. Mr. Turner's locality marks the extreme western limit of the known range of *L. biplicata*, and it is hoped that further search may reveal other colonies of this very local snail in the west of England. Mr. Overton's record of *Pisidium pseudosphaerium* Favre from Somerset is also of special interest, being the second British locality for this species (see *J. Conchol.* **23**, 27).

Doubt has been expressed about the Census records of *Planorbis laevis* Alder (= *P. glaber* Jeffreys) for N. and S. Wilts (vice-counties 7 and 8), as the species has not recently been taken in those areas. The record for both vice-counties rests on four specimens in the Townsend collection in Haslemere Educational Museum, labelled Great Bedwyn, 1851. This determination was verified by J. W. Taylor in 1906, and I concur with the opinion of Colonel Bensley, by whose kindness I have been enabled to examine the specimens, that they have been correctly identified. Great Bedwyn, however, lies on the boundary between Watson's subdivisions of the county, and in the absence of any more precise data it is now impossible to decide to which vice-county *P. laevis* should be credited. Unless Townsend's specimens were taken in the Kennet and

Avon canal, the locus must have lain on one side or the other of the vice-comital boundary, and it gives a misleading conception of the distribution and frequency of this species to assign it to the whole of Wiltshire on the strength of this single century-old record. Pending the possible rediscovery of *P. laevis* at Great Bedwyn or elsewhere in Wiltshire, this species should be indicated as requiring confirmation for both N. and S. Wilts.

It is particularly requested that specimens of slugs, *Succinea* and *Vitrina* for determination, which must be either alive or preserved, after drowning, in 70 per cent alcohol, should *not* be sent to the Recorder but to Dr. H. E. Quick, whose new address is 59 Alexandra Road, Reading, Berks.

A. E. Ellis.

Recorder's Report: Marine Mollusca.

The following list of species collected by Mr. T. G. W. Fowler at Pentle Bay, Tresco, Isles of Scilly, came to hand too late for the last Report:—

Solecurtus scopula (Turton): four living, two very large; examples are often dredged here but generally dead.

Diplodonta rotundata (Montagu): a few living and many dead.

Cardium (*Laevicardium*) *crassum* Gmelin: living, very large.

Venus verrucosa L. and *V. casina* L.: numerous, living.

Montacuta substriata (Montagu) and *Mysella bidentata* (Montagu): living on *Spatangus purpureus* Müller.

Tellina donacina L.: one pure white and many of the normal colour.

Clathrus clathrus (L.): far less numerous than formerly.

Gibbula cineraria (L.): streaked with white. *G. magus* (L.): remarkably large.

Mr. Fowler failed to find *Pinna fragilis* Pennant where it used to occur; the *Zostera* seems to have perished here as it has done at Salcombe recently.

From Sennen, West Cornwall, Mr. Fowler reports several specimens of *Sepia* (*Parasepia*) *orbigniana* Férussac and numerous *S.* (*Rhombosepion*) *elegans* Orbigny.

The Rev. Canon L. W. Grensted has sent an account of his observations at Aberporth, Cardiganshire (Region XIb). He mentions over 60 species seen there, of which the following had not been recorded on the maps: *Diodora apertura* (Montagu), dead; *Tricolia pullus pictus* (da Costa); *Littorina neritoides petraea* (Montagu); *Bittium reticulatum* (da Costa); *Nassarius reticulatus* (L.); *Modiolus modiolus* (L.); *Musculus marmoratus* (Forbes); *M. costulatus* (Risso); *Ostrea edulis* L.; *Thyasira flexuosa* (Montagu); *Mysella bidentata* (Montagu); *Dosinia lupinus lincta* (Montagu); *Mysia undata* (Pennant); *Venerupis pullastra* (Montagu); *Aloidis gibba* (Olivi); *Dentalium entalis* L. and *D. vulgare* (da Costa), both dead but in good condition.

The numbers of the other species found by Canon Grensted, according to Winckworth's List (*J. Conchol.* **19**, 217 *et seq.*), are as follows:

Gastropoda: 7, 10, 25, 26, 37, 40–42, 45, 71, 87, 100, 170, 176, 179, 190, 192, 204, 208, 222, 228. Lamellibranchia: 2, 15, 17, 20, 42–44, 84, 87, 93, 94, 101, 102, 112, 116, 120, 126, 129, 135, 137, 141–145. Canon Grensted remarks on the absence of *Macoma balthica* (L.) and *Tellina tenuis* da Costa, and the great numbers of *Abra alba* (W. Wood) washed up with *Tellina fabula* Gmelin.

Miss Bush reports that she collected 13 *Janthina britannica* Forbes and Hanley and one *J. planispirata* Adams and Reeve, alive with perfect animal and float, at Constantine Bay near Padstow, 16 September 1935.

Mr. Fowler was collecting at Oban in late September and early October 1949. His list includes all the rare species found on this rich ground. In the Loricata he records 2, 4, 6, 8, but not *Tonicella marmorea* (Fabricius); in two collecting trips in different Aprils many years ago I found this in plenty at Kerrera ferry, Oban, so perhaps it disappears in the autumn. Mr. Fowler also notes the almost complete disappearance of *Chlamys nivea* (Macgillivray) from the Laminaria exposed at low tide and from that dragged up with grappling irons; I found this species also in great numbers in April. Mr. Fowler's most important finds include the following: Gastropoda: 4, 6, 15, 16, 166, 179 (a new white form of *V. velutina*), 187; Lamellibranchia: 41 (scarce), 42 (a new white form of *C. varia* with very broad ribs), 43, 44, 47, 48, 51, 52, 65 (three dead but fresh in Firth of Lorne).

Canon Grensted has sent a report on collecting in Region X. At Waterloo on the Mersey estuary he found very few surviving species: *Macoma balthica* (L.) and *Cardium edule* L. were abundant; a few *Littorina littorea* (L.) on a drain-pipe and *Mytilus edulis* L. on a wall; *Turritella communis* Risso, *Nucula nucleus* (L.), *Cardium echinatum* L., *Tellina fabula* Gmelin, *Donax vittatus* (da Costa), *Scrobicularia plana* (da Costa), *Abra alba* (W. Wood), *Barnea candida* (L.) and many other species were found dead, a striking example of the destruction of marine life which is so general. At Ainsdale conditions were better and the following were noted: Gastropoda: 48, 53, 87, 106, 107, 111, 126, 137, 176, 203, 209, 230, 247; Lamellibranchia: 2, 20, 22, 47, 79, 80, 84, 87, 93, 100, 102, 103, 112, 116–118, 123, 126, 135, 137, 141–145, 147, 148, 150, 157.

Canon Grensted has sent a further note on the Mollusca of Poole, Dorset (Region VI). He remarks on the almost complete absence of *Venus striatula* (da Costa) and *Donax vittatus* (da Costa) and the scarcity of *Tellina fabula* Gmelin, remarkable for such a sandy shore. He states that fifteen years ago he did not see *Petricola pholadiformis* Lamarck, which is now common. *Crepidula fornicata* (L.) has become very common. The following species had not been marked on the census maps (an asterisk indicates that only dead shells were found): *Cyprina islandica* (L.), *Tellina tenuis* da Costa, **Scrobicularia plana* (da Costa), **Venus verrucosa* L., **Mysia undata* (Pennant), **Gari depressa* (Pennant), **Mya arenaria* L., **M. truncata* L., **Lutraria lutraria* (L.), *Ensis siliqua* (L.), *Solen marginatus* Montagu, **Rissoella opalina* (Jeffreys), **Odostomia turrita* Hanley, **Mangelia brachystoma* (Philippi), **Retusa alba* (Kanmacher). The remaining species observed by Canon Grensted are indicated by their numbers in Winckworth's List: Lamellibranchia: 13, 16, 20, 29, *30, *35, *42, 44, *64, *79, *88, 93, *94, 106, *108, 110, 112, *123, 126, 141, 143, 144, *150, 152, 156, 170, 176; Gastropoda: 41, 42, 45, 55, 71, 74, 90, *140, 168, 184a, 184b, 190, 192, 207–209, 247, 373.

I should be glad if any members could send particulars of Southport. The late Loftus Byne told me that he and Dr. Chester had examined a remarkable line of dead shells there and that it was difficult to say whence they had come. Information is also wanted about recent living occurrences of the following species: *Caecum imperforatum* (Kanmacher) and *C. glabrum* (Montagu); all species of *Balcis* Leach and related genera; subspecies of *Littorina saxatilis* (Olivi); *Berthella plumula* (Montagu); *Berthellina engeli* Gardiner; *Trivia monacha* (da Costa) and *T. arctica* (Montagu).

ALAN P. GARDINER.

693rd Meeting, held at the British Museum (Natural History), 21 January 1950.

The President in the chair.

Exhibits.

Special exhibit: *Viviparus*.

The President: paintings of stages in the life-history of *Viviparus viviparus* (L.) and a mounted series of embryonic shells.

Mr. C. P. Castell: some British fossil Viviparidae, ranging from the Jurassic (Purbeck Beds) to the Pleistocene.

Mr. H. F. Jones: a series of *Xesta citrina* (L.).

Dr. H. E. Quick: *Viviparus* showing embryos; living *Agriolimax caruanae* Pollonera with eggs and newly hatched young from Old Colwyn, Denbighshire.

Mr. L. W. Stratton: *Viviparus* from Hertfordshire.

Mr. T. Pain: African, Oriental and Siberian species of Viviparidae.

694th Meeting, held at the British Museum (Natural History), 18 February 1950.

The President in the chair.

Election of Members.

Wordsworth Donisthorpe Fisher, 576 King Lane, Moortown, Leeds.
Albert Larkman, 28 Broadway, Kettering, Northants.

Communications.

"*Planorbis corneus* (L.) var. *rubra* Oldham," by L. W. Stratton.

"Habitat of *Clausilia rolphii* Turton," by L. W. Stratton.

"*Laciniaria biplicata* (Montagu) in Somerset," by A. H. Turner.

Exhibits.

Special exhibit: Planorbidae.

The President: a selection of British and Continental Planorbidae.

Lieut.-Colonel C. J. F. Bensley: *Planorbis corneus* (L.) 35 mm. in diameter from Frensham Great Pond, Surrey.

Mr. D. E. Brown: *Planorbis corneus* and *P. albus* Müller from Hampstead Heath; alien Planorbid, cf. *Helisoma duryi* (Wetherby), from the Reptile House, Zoological Gardens, London.

Mr. C. P. Castell: fossil Planorbidae from the Headon Beds, Bembridge limestone, Norwich Crag, etc.; *Planorbis acronicus* Férussac (Holocene) from various localities.

Mr. A. E. Ellis: British and Continental Planorbidae, including *P. vorticulus* Troschel from every known English locality; a series of all the British species of *Succinea*, including *S. sarsi* Esmark (see p. 117) from Herts, Essex and Kent (*ex* Pickering collection).

Mr. T. Pain: *Ceratodes cornu-arietis* (L.), West Indies, tropical Central and South America.

Dr. H. E. Quick: *Limax flavus* L. and eggs; *Vitrina pellucida* (Müller), eggs, young and adults.

Mr. L. W. Stratton: specimens to illustrate his paper on *P. corneus*; British species of Planorbidae.

695th Meeting, held at the British Museum (Natural History), 18 March 1950.

The President in the chair.

Election of Member.

C. Swaneveld, 193 Krepelstraat, Zierikzee, Holland.

Communications.

"A new species of *Pomacea* (*Limnopomus*) from Venezuela," by T. Pain.

"Longevity of Conchologists," by A. Comfort.

"*Odostomia eulimoides* Hanley on *Chlamys varia* (L.)," by B. S. Kisch.

"Growth stages of *Cylope neritea* (L.)," by B. S. Kisch.

Exhibits.

Special exhibit: British Slugs.

The President: water-colour drawings and shells of slugs.

Mr. D. E. Brown: skins of slugs mounted on glass slides and slugs preserved in spirit.

Mr. A. E. Ellis: shells of all the British species of slugs, *Vitrina* and *Zonitidae*.

Mr. T. Pain: specimens of *Pomacea* to illustrate his paper.

Dr. H. E. Quick: living and preserved slugs and shells of British slugs.

Mr. C. P. Castell (from the collections of B. B. Woodward and A. S. Kennard in the British Museum): recent and fossil shells of British slugs, with figures from Taylor's *Monograph*, volume 2.

696th Meeting, held at the British Museum (Natural History), 22 April 1950.

The President in the chair.

Election of Members.

Stanley Peter Dance, 97 Powney Road, Maidenhead, Berkshire.
The Nature Conservancy, Thorney House, Smith Square, London, S.W. 1.
J. C. A. Whitworth, B.A., The Cottage, Flax Bourton, Somerset.

Communications.

"The alleged occurrence of *Helix aspersa* Müller in kitchen middens in Cheshire," by Mrs. N. F. McMillan.

"The resistance of *Littorina saxatilis* (Olivi) to lowered salinity," by Mrs. N. F. McMillan.

"Additional Notes on Joseph Wilcock," by Mrs. N. F. McMillan.

"Mollusca of a sewage works," by W. D. Fisher.

"*Crepidula fornicata* (L.) in Torbay," by P. P. Milman.

"*Succinea putris* (L.) parasitized by *Leucochloridium*," by A. E. Ellis.

"The type species of *Testacella*," by A. E. Ellis.

Exhibits.

Special exhibit: Mollusca of Lake Tanganyika. Mr. T. Pain exhibited a series of shells from L. Tanganyika, and gave an outline of the history of the lake.

697th Meeting, held at the British Museum (Natural History), 20 May 1950.

The President in the chair.

Election of Member.

Day Kimball, 29 Montpellier Square, London, S.W. 7.

Communications.

"*Hygromia cinctella* (Draparnaud) in England," by A. Comfort.

"The spermatophore of *Milax sowerbii* (Férussac)," by H. E. Quick.

Exhibits.

The President: models of *Pholas dactylus*, *Mya truncata* and *Ancylus fluviatilis*; paintings of *Testacella haliotidea* and *T. scutulum*; living *Zebrina detrita* and *Alopia dacica* (Pfeiffer) introduced with tree-frogs.

Dr. A. Comfort: *Hygromia cinctella* and *H. limbata* from South Devon.

Mr. A. E. Ellis: British and Continental species of *Hygromia*.

Dr. H. E. Quick: living *Testacella haliotidea*; preserved specimen and mounted radula of *T. scutulum*.

Mr. C. P. Castell: recent and fossil Ancylidae from the British Museum collections.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1949.

Income and Expenditure Account.

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
Paid in 1948	8	4	0			
For 1949	80	10	0			
Arrears	34	0	0	122	14	0
,, Sales				32	0	9
,, Transfer from Life Membership Fund	21	10	0			
,, Research Fund	11	7	0	32	17	0
,, Sales of Waste Paper				1	16	9
				£189	8	6

Cr.

	£	s.	d.	£	s.	d.
By Publication and Distribution—						
Reprints, vol. 23, part 1	6	19	10			
Journal, vol. 23, part 2	66	8	7			
Reprints, vol. 23, part 2	8	4	11	81	13	4
,, Printing and Stationery				9	12	0
,, Fire Insurance				1	0	0
,, Zoological Record					8	0
,, Officers' Expenses	6	18	10			
,, Travelling	2	10	5	9	9	3
Balance, being excess of Income over Expenditure				87	5	11
				£189	8	6

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1949	472	6	0
,, Bequest (A. J. Peile)	17	8	0
,, Dividends and Interest	21	10	0
	£511	4	0

	£	s.	d.
By Transfer to Income and Expenditure Account	21	10	0
,, Amount of Fund, 31 December 1949	489	14	0
	£511	4	0

Research Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1949	256	16	0	By Transfer to Income and Expenditure Account	11	7	0
,, Dividends and Interest	11	7	0	,, Amount of Fund, 31 December 1949	256	16	0
	£268	3	0		£268	3	0

BALANCE SHEET.

LIABILITIES.	£	s.	d.	£	s.	d.
Annual Subscriptions in advance				10	3	0
Life Membership Fund				489	14	0
Research Fund				256	16	0
Transfer from Research Fund				100	0	0
Balance from Income and Expenditure Account—						
As on 1 January 1949	203	1	4			
For 1949	87	5	11	290	7	3
				£1,147	0	3

ASSETS.	£	s.	d.	£	s.	d.
4% Funding Loan (cost)	350	0	0			
2½% Defence Bonds (cost)	200	0	0			
3½% War Loan (cost)	40	0	0	590	0	0
Cash at Bankers—						
National Provincial Bank	115	17	0			
Post Office Savings Bank	433	4	0			
Cash in hand	7	19	3	557	0	3
				£1,147	0	3

NOTE.—Assets in addition to those set out in the above Balance Sheet are (*a*) Library, (*b*) Cabinets and Collections, (*c*) Stock of unsold Publications, (*d*) Annual Subscriptions in arrears, but against this as a Liability is the cost of the *Journal*, vol. 23, part 3, issued in December, for which the account, amounting to £50 2*s*. 9*d*., was not received in time for inclusion in the above statement.

Audited and found correct.
G. L. WILKINS.
C. P. CASTELL.
18 March 1950.

ALBERT E. SALISBURY,
Hon. Treasurer.
24 February 1950.

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Smithsonian Institution
MAR 27 1951
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British Museum
(Natural History),
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A.M.I.E.E.,
51 Amersham Hill,
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And also of the Secretary of the Society.

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SUBSCRIPTIONS became due on 1 January and Members who have not already done so are asked to remit to the Hon. Treasurer without further delay. Those who are in arrears by more than a year cannot expect to receive copies of the *Journal* until their subscription is paid. Members are reminded that the annual subscription is now £1. The mounting cost of printing makes it essential that subscriptions should be promptly paid if the *Journal* is to be published at regular intervals. At present it is financially prohibitive to produce more than two numbers a year. Donations towards the cost of Publication would, of course, be gratefully welcomed by the Hon. Treasurer.

THE
JOURNAL OF CONCHOLOGY

Vol. 23. 5 MARCH 1951. No. 5.

A LIST OF THE MARINE MOLLUSCA OF THE BRITISH ISLES: ADDITIONS AND CORRECTIONS.

By R. Winckworth.

(*Read before the Society*, 21 *October* 1950.)

[Editor's note: The late Mr. R. Winckworth made a considerable number of emendations and corrections in manuscript to his "List of the Marine Mollusca of the British Isles" (*J. Conchol.* **19,** 1932, pp. 217–250). Some of these have already been published (*J. Conchol.* **19,** 334, **20,** 9, 51), but it is considered desirable to bring all the corrections together for convenience of reference.]

p. 219 : for *Schizotrochus* substitute Anatoma Woodward, 1859.
    9 : for *athletica* substitute **aspera** Röding, 1798.
    11 : *laevis* is a form of *pellucida*.
p. 220 : delete *Monodonta*; rearrange genera and subgenera as follows:—
        CANTHARIDUS
            s.g. Clelandella
            s.g. Jujubinus
        GIBBULA
            s.g. Osilinus
            s.g. Gibbula
p. 221 : *Littorina* Férussac is *nom. nud.*; the genus dates from Payraudeau, 1826, type *Turbo neritoides* L. (see *Proc. Malac. Soc.* **25,** 116). *L. littorea* (L.) is the type of s.g. Algaroda Dall, 1918; for s.g. *Melarhaphe* substitute s.g. Littorina *s.s.*
    51 : *fulgida* is not a *Cingula* and not a Rissoid; refer provisionally to **PSEUDOSETIA** Monterosato, 1884, type *Rissoa turgida* Jeffreys.
p. 222 : 69 : *sarsii* should be placed in *Alvania*.
p. 223 : *Tornus*: after 79 add **unisulcatus** (Chaster, 1897).
p. 224 : *Bittium*: after 90 add **simplex** (Jeffreys, 1867). J4, 259.
    Janthina: after 104 add **planispirata** Adams & Reeve, 1850.
        pallida Thompson, 1840.
        exigua Lamarck, 1816.
p. 225 : Pyramidellidae are Opisthobranchia (see *J. Mar. Biol. Assoc.* **28,** 493).
p. 226 : **BRACHYSTOMIA** is a genus, and should precede *Odostomia*.
p. 227 : *pespelicani*: Linnaeus spelt the name *pes-pelecani*.
p. 228 : for *Lunatia* substitute Euspira Agassiz, 1838: type, *Natica glaucinoides* J. Sowerby.

MAR 26 1951

180: *plicatilis* is the type of s.g. VELUTELLA Gray, 1847.
Transfer *Erato* and *Trivia* to ERATOIDAE, which should precede Lamellariidae.
Trivia Broderip (not Gray).
Delete 184*a*; 184*b* is a species, **arctica** (Montagu).
Transfer *Simnia* to OVULIDAE.
GALEODEA Link, 1807, replaces *Cassidaria*.

p. 229: *Beringius* Dall, 1879 (not Scudder).
Neptunea: type, *N. contraria* Röding.

p. 231: top line: 1828 (not 1821); add Mediterranean.
BULLOMORPHA replaces Pleurocoela.
Rearrange families in following order: Acteonidae, Diaphanidae, Retusidae, Atyidae, Triclidae, Akeratidae, Philinidae, Peltidae.
232 and 233 are varieties of 231 *minuta*.
241 is variety of 240 *subcylindrica*.

p. 232: Transfer *Colpodaspis* to Diaphanidae.
For Tethyidae substitute APLYSIIDAE, and for *Tethys* **APLYSIA** Linné, 1767 (*nom. cons.*): type, *A. depilans* L.
Transfer family to APLYSIOMORPHA, placed after Pteropoda.
After 256 add **depilans** L. and **limacina** L.

p. 233: After 266 add (see *Proc. Malac. Soc.* **23,** 231):—

Order ACOCHLIDIACEA

HEDYLOPSIS Thiele, 1931. *Hedyle spiculifera* Kowalevsky.
Q **suecica** Odhner, 1937.
269: *bellulus* (not *bellula*).
272: **senestra** Quatrefages replaces *cocksii*.
For Acoela substitute PLEUROBRANCHOMORPHA.

p. 234: Top line, before *plumula* insert **BERTHELLINA** Gardiner, 1936.
engeli Gardiner replaces *plumula*; delete *Q*.
Before Tritoniidae insert Order NUDIBRANCHIA; rearrange families as follows: Glossodorididae, Limaciidae, Tritoniidae, Lomanotidae, Hancockiidae, Scyllaeidae, Dendronotidae, Dotoidae, Arminidae, Proctonotidae, Heroidae, Coryphellidae, Eubranchidae, Tergipedidae, Calmidae, Fionidae, Facelinidae, Aeolidiidae; LIMACIIDAE replaces Polyceridae.
LIMACIA Müller, 1781, replaces *Euphurus*.
282: *clavigera* (not *claviger*).
Palio reduced to a subgenus of *Polycera*.
Polycera Cuvier, 1817 (not 1816).
290: *pilosa* (Müller); Abildgaard published some of Müller's work posthumously.

p. 235: GLOSSODORIDIDAE replaces Argidae.
ECHINOCHILA Mörch, 1869, replaces *Cadlina*.
312: **pseudoargus** (Rapp, 1827) replaces *britannica*.
313: *flammea* is a variety of 312.
After 315 add **sticta** Iredale & O'Donoghue, 1923.

p. 236 : For *Zephyrina* (indeterminate) substitute **PROCTONOTUS** Alder & Hancock, 1844, and for *Janolus* substitute **ANTIOPELLA** Hoyle, 1902 ; change family name to PROCTONOTIDAE.
Before *Hancockia* insert HANCOCKIIDAE.
329 : **uncinata** (Hesse, 1872) replaces *eudactylota.*
DOTO Oken, 1815, replaces *Idulia*, and family name becomes DOTOIDAE (*Doto* Oken, 1807, is *nom. nud.*).
CORYPHELLIDAE replaces Flabellinidae.
335*b* : **pelludica** (A. & H.) is a species.
Delete 337 *salmonacea.*
After 338 add **gracilis** (Alder & Hancock).
Before *Eubranchus* insert EUBRANCHIDAE.
339*b* : **pallidus** (A. & H.) is a species.

p. 237 : 347 : delete brackets.
350 : transfer *peachii* to **PRECUTHONA** Odhner, 1929.
For *Cratena* substitute **TRINCHESIA** Ihering, 1879.
FACELINIDAE replaces Aeolididae.

p. 238 : 364 : *branchialis* (Müller) ; published posthumously.
366 : *drummondi* is variety of 367.
367 : **auriculata** (Müller, 1776) replaces *longicornis.*
368 : **annulicornis** (Chamisso & Eysenhart, 1821) replaces *punctata.*
Before *Aeolidia* insert AEOLIDIIDAE.
For *Eolidina* substitute **AEOLIDIELLA** Bergh, 1874 : type *A. occidentalis* Bergh.
LEUCOPHYTIA Winckworth, 1949, replaces *Leucopepla.*
Transfer Onchidiidae to Order SILICODERMATA.

p. 239 : 2 : *nucleus* : J2, 215 (not 143).
Yoldiella : delete *lenticula* ; 9 **tomlini** is a species.
Arca : type, *A. noae* L. ; *Navicula* = s.g. ARCA *s.s.*
For *Barbatia* substitute STRIARCA Conrad, 1862 : type, *Arca centenaria* Say.

p. 240 : For *Adula* substitute **ADIPICOLA** Dautzenberg, 1927 : type, *Modiola pelagica* Woodward.
Transfer Ostreidae to Order OSTREIFORMES.

p. 241 : 40 is not *islandica* but **sulcata** (Müller, 1776) (from specimens *ex. auct.*).
Limaria replaced by PROMANTELLUM Iredale, 1939 : type, *P. parafragile* Iredale.

p. 242 : Before *Neolepton* insert NEOLEPTONIDAE.
NEOLEPTON is a genus.

p. 243 : **EPILEPTON** is a genus.
Delete *Entovalva* ; **DEVONIA** is a genus.
GLOSSIDAE replaces Isocardiidae.

p. 244 : 95 & 96 : references are to FH1 (not 2).
101 : delete brackets.
For *Paphia* substitute **VENERUPIS.**
104 : *aurea* is in s.g. POLITITAPES Chiamenti, 1900.
106 : reference should be FH 1, 382.

p. 245 : after 121 add **britannica** Tomlin, 1934.
123*a* : place " Linné " in brackets.
SCROBICULARIIDAE replaces Semelidae.
126 : *alba* (W. Wood), not S. Wood.
Transfer *Solecurtus* to Asaphidae.

p. 246 : *Zozia* replaced by AZORINUS Recluz, 1869.
For *Aloidis* substitute **CORBULA** Lamarck, 1799 (*nom. conserv.*) : type, *C. sulcata.*
150 : *gibba* is the type of s.g. VARICORBULA Grant & Gale, 1931.

p. 247 : 152 : **striata** Fleuriau, 1802, replaces *gallicana.*
Delete *Q* before *pholadis.*
158 : reference should be FH 1, 111.
163 : Spengler's spelling is *norvagicus.*
LATERNULIDAE replaces Periplomatidae.

p. 248 : For Pandora substitute **CALOPODIUM** Röding, 1798 : type, *C. albidum* Röding ; family name becomes CALOPODIIDAE.
176 : **albidum** Röding, 1798, replaces *margaritacea.*
For *Todarodes* substitute **SAGITTATUS** Risso, 1854.

p. 249 : 8 : **vulgaris** Lamarck preferable, as *loligo* L. is difficult to determine.
9*c* is not separable from 9*b*.
10 : shell only of *orbigniana*, not animal, has been found in British waters.
Delete s.g. *Parasepia* and *Rhombosepion.*
Delete *Q* before *neglecta.*
15 : *macrosoma* (Chiaje, 1829).
For Octobrachiata substitute OCTOPODA.

***Assiminea grayana* Fleming in the Humber.**—Whilst collecting Coleoptera on 28 June 1950 on one of the small salt marshes at Hessle, S.E. Yorks, on the bank of the Humber, I found a large colony of *Assiminea grayana* Fleming. The molluscs were mostly crawling about on the surface of the mud, or on the woodwork at the edge of the salt marsh. In all places where I found *Assiminea*, Sea Aster (*A. tripolium*) occurred, along with a *Carex* and various grasses. Being interested to find out whether *Assiminea* occurs also on the Lincolnshire shore, I visited New Holland on 28 October 1950 with Mr. Charles Proctor of Hull, and within a very short time found it in a similar situation, though very sparsely. *Phytia myosotis* (Draparnaud) was also present in this locality. The Humber is about 70 miles north of the nearest known localities for *A. grayana* on the Norfolk coast.

ARTHUR SMITH.

(*Read before the Society*, 18 *November* 1950.)

HYGROMIA CINCTELLA (DRAPARNAUD) AT PAIGNTON.

By P. P. Milman.

(*Read before the Society*, 21 *October* 1950.)

In May 1945 in a private back-road about 100 yards from my house in St. Michael's Road, I found some snails (two young alive and a few dead shells) which I took for *Hygromia limbata* (Draparnaud). In June 1946 living snails and dead shells were fairly plentiful in this spot. I collected a considerable number, and released about 20 half-way to Roundham Head, about half a mile away; in July 1950 40 dead shells were found there, but none living, the weather being dry. A further 30 snails were distributed in certain back-roads (Stafford Road, open space between Adelphi Road and Torbay Road), on the rockery by the bandstand, and in Victoria Park. Subsequent visits showed that these snails of my second " planting " had become established, but had not wandered far. On reading Dr. Comfort's account (*J. Conchol.* **23**, 99) of his discovery of *Hygromia cinctella* at Paignton, I at once realized that the snails I had found in 1945 and mistaken for *H. limbata* are in fact *H. cinctella*, and sent specimens to Mr. A. E. Ellis, who confirmed this identification. I had never seen *H. limbata* until Mr. Ellis sent me specimens, but knowing that it occurs near Teignmouth, I assumed that the Paignton snails were the same.

It is exceedingly improbable that either of these two species of *Hygromia* is native in South Devon. I can suggest two possible means of introduction. Cider apples are annually sent in quantities from France and landed at Paignton and Teignmouth. The apples are sent across " rough ", that is roughly scooped up, together with grass, weeds and leaves, in the orchards, and then washed in Paignton and Teignmouth. Barges used to convey foreign apples from Teignmouth to Combe Cellars, where *H. limbata* is plentiful, and this species, which is naturalized in N.W. France, may well have been introduced in this manner. Another possibility, which I am inclined to think is more likely in the case of *H. cinctella*, is that the snails were introduced with trees and shrubs from the Continent. Great numbers of foreign plants have been imported into South Devon, and I have shown that it is easy to establish new colonies of *H. cinctella*. It seems that either the cider trade or the horticulturist, or both, may well provide the clue to the presence of these two alien species of snails in South Devon.

DISTRIBUTION OF *HYGROMIA CINCTELLA* (DRAPARNAUD) AT PAIGNTON.

By A. Comfort.

(*Read before the Society,* 16 *December* 1950.)

The initial report of *H. cinctella* in Devon, where it was found in the spring of 1950, described two colonies, both close to the sea (*J. Conchol.* **23**, 99). Further specimens have since been identified by Mr. Milman among material taken in the town itself. I undertook further collecting during September 1950 to determine the range and relative prevalence of the species : it now appears that *H. cinctella* is widely and plentifully represented in and around Paignton town, though it has not yet been found outside a bridgehead extending from Roundham to Hollicombe and inland as far as Paignton cemetery.

The species is widespread in hedges, gardens and waste land, under ivy and on rockeries and in nettle beds within this area. The largest colony extends for about 200 yards on an ivy-covered hedgebank north of the cemetery (Ailescombe Road) and probably northward into adjacent allotments. The other sites are summarized below (table 1). In this large colony the population-density is very high, and the species has almost certainly passed the point at which it could easily be exterminated by a hard winter. It does not seem to have reached the cliff gardens at Torquay and Babbacombe in the north, or a number of suitable sites around Elberry in the south. It does not occur at Berry Pomeroy, where almost all the other local species are established in the castle ruins and adjacent sheltered woods. Under rock-plants and in nettles it associates with *Hygromia striolata* and *Monacha granulata*, but on sheltered hedgebanks covered with ivy it is far less geophile and climbs to a considerable height, adhering to leaves with *Helix hortensis* and *H. aspersa*. In most colonies whitish specimens outnumber brown. Some adults reach a diameter of almost 20 mm.

My collecting suggests that the species is still circumscribed, though well-established in sheltered places, but introduction elsewhere may well have taken place already and spread seems likely. It is possible that the original focus of introduction was at Oldway, where many foreign plants were brought over in laying out the gardens. In view of its local prevalence the species should be looked for elsewhere in South Devon.

Table 1.

Site.	*Habitat.*	
Roundham	Ivy on walls, under umbellifers, in cliff garden.	Prevalent
Hollicombe	Nettles adjacent to railway	Prevalent
Hollicombe	Nettle beds by footbridge	Prevalent
Ailescombe Rd.	Ivy on hedgebank	Large breeding colony
Polsham Rd.	Garden bank	Dead shells
Oldway	Rockeries	Prevalent
N.W. of Oldway	Waste land, hedges	Dead shells

THE NORTH EUROPEAN *HELICELLA*.

By Hans Schlesch.

(*Read before the Society*, 21 *October* 1950.)

Denmark, in consequence of the North Sea current flowing among the Danish coasts and isles and farther into the Baltic, forms an oceanic enclave, to which also belong Schleswig, Holstein, part of Mecklenburg with Rügen, the coastal regions of Pomerania, West and East Prussia, the coastal regions of the east Baltic states, as well as Sweden and the lower coastal stretches of Finland, and the islands Öland, Gotland, Dagö, Ösel, etc., with an oceanic climate. Any clearly defined limit to the faunal region does not exist. The first immigration into Denmark and Scandinavia took place both from the south-west, through Schleswig and Denmark, which until the *Littorina* submersion during the Continental period were joined to the southern part of the Scandinavian peninsula, and from the south-east. But invasion by new elements still occurs, some of which gain a foothold and became acclimatized, while others disappear during icy winters or unfavourable conditions.

Among such species particularly suited to transport for a prolonged period the genus *Helicella* definitely belongs ; furthermore species of this genus are not by nature exacting as regards habitat, preferring rubbish, cliffs or slopes, etc., with dry calcareous soil and sunshine, while the oceanic species demand greater air humidity. Moreover we are in north Europe at the utmost limit for those genera the species of which cannot endure very severe winters. It is, however, interesting to note that certain species of *Helicella* during recent decades, possibly owing to change of climate, have increased in range and power of adaptation, for instance *Helicella* (*Candidula*) *caperata* (Montagu) in Holstein and Schleswig (Jaeckel 1949, 64) and also in Denmark, where this species was previously only known from very few localities (Steenberg 1911, 91), but is now known from a great many localities from North Jutland (northwards to Aalborg and Glyngöre on Limfjord) and the Danish isles eastwards as far as Bornholm ; it seems, however, not yet to have invaded the western regions of Schleswig and western Jutland. Dr. C. Krausp collected *H. caperata*, together with *H. itala* (L.), at Schloss Dwasieden, near Sassnitz, Rügen, September 1950. Strange to say, the species has not appeared in Scania, though it occurs on the east coast of the isle of Saltholm in the southern part of the Sound (Öresund), at a distance of merely 12 kilometres from the lime-quarries at Limhamn and Klagshamn south of Malmö, which consist of the same calcareous deposits belonging to the Danium-level. It is moreover characteristic that most of the occurrences of *H. caperata*, with the exception of the lake districts in south-east Holstein, at present seem to be along or near the coast. It is actually recorded both from Lower Saxony and Thuringia, but so far as I am able to determine from material in my collection, the occurrence at Mascherode in Brunswick seems to be *H. gigaxii* (Pfeiffer), while those from Coburg look more like *H. candidula* (Studer). Especially with all smaller *Helicella* it is necessary to examine all populations anatomically. Only on Möen in the south-eastern part of Denmark is *H. caperata* dispersed over the isle, and this applies possibly in a higher degree to *H. candidula*, though the latter species so far as is known does not occur outside the isle of Möen within Danish territory, where it was first with certainty identified by me, 2 July 1933 (Schlesch 1934, 43). *H. candidula* is further known from Hanaskog lime-quarry, 14 kilometres north of Kristianstad, in north-eastern Scania, where it was first found by Richard Hägg, 1929 (Bernström 1935, 264), and in southern Mecklenburg at Neuenkirchen near Neubrandenburg, and Mecklenburg-Neustrelitz at Feldberg near Neustrelitz (Steusloff 1917); it is dispersed in Brandenburg (Rüdersdorf near Berlin, Wolgast, Kr. Friedeberg in Neumark, Landsberg a. Warthe, etc.), and at Bodlewo near Poznań (Urbański 1933, 85–86); the proper area of its more general extension is, however, along a line of 52°. Also *H. gigaxii* is hitherto known in north Europe only from a small area in the south-eastern part of Möen (Schlesch 1943, 176); the record for Eutin in south-eastern Holstein has not been subsequently corroborated, and when Dr. S. Jaeckel junr. and the present writer examined the spot in 1932 we only found *H. caperata*.

An isolated record was also *H.* (*Xerotricha*) *conspurcata* (Draparnaud), of which I found only a single specimen at Ermelunden, near Copenhagen, on 10 October 1931, and which has not since been observed (Schlesch 1942, 109). This species, however, was previously recorded (10 specimens) from Dyrehaveskov near Nyborg in east Fünen (Mörch 1864, 282) and from Christiansfeld in north-eastern Schleswig, where it "is said" to have been found (Mörch 1864, 282). The old records of *H. candidula* from Itzehoe in Holstein and "noticed in a single specimen" amongst the *H. conspurcata* above-mentioned from Dyrehaveskov (in Lassen's collection) may be disregarded, while the same applies to *Cochlicella acuta* (Müller), of which a single specimen is stated to have been found by Budde-Lund near Nyköbing in N.W. Zealand and not later found there (Steenberg 1911, 93). It is of interest that Steusloff at Neubrandenburg in southern Mecklenburg found *H.* (*Xeroplexa*) *bollenensis* (Locard), which he named *bolli* Steusloff, a native of the eastern Pyrenees and the maritime alps of south-eastern France, but also known isolated at Ochsenfurt on the Main and Steinberg near Würzburg (Ehrmann 1933, 123). The south-east European *H.* (*Helicella*) *obvia* (Hartmann) is spreading rapidly and a single living specimen was observed at Ochtrup in Holland by Odé recently (*Correspondentieblad Nederland. Malac. Vereeniging*, No. 27, April 1947, 165); it was found by W. Emeis in 1920 on grassy banks of the Kiel Canal near Rendsburg in southern Schleswig, where a small form is very numerous and apparently spreading, as it is also found at the canal at Schülp and at the Untertrave (Lower Trave) near Schlutup (Jaekel 1949, 62). This species is now commonly met with in southern Mecklenburg, through Brandenburg (presumably imported to Potsdam near Berlin between 1766–1829), on the isle of Wollin and two localities on Rügen, also in Pomerania, East Prussia and in south-eastern East Prussia at the lake of Treuburg, where it was collected in 1942 by W. La Baume (material in my collection); the record from Krasnoje Selo near St. Petersburg by Siemaschko, 1849, is certainly only an accidental introduction. The northernmost occurrence for *H. obvia* therefore at present seems to be Rendsburg and Rügen, but occasionally a single specimen is found at Helsingborg in Scania (Ailly 1907, 171–173) and C. M. Poulsen in 1841 noticed many living specimens in the zirconium quarry at Frederiksværn in south-eastern Norway, but it later became extinct (Ökland 1925, 121).

The closely related Mediterranean–West European *H.* (*Helicella*) *itala* (L.) occurred nearly 100 years ago at Aalborg in N. Jutland and in north-eastern Zealand at Stavnsholt-Bidstrup, but died out (Mörch 1864, 283 ; Steenberg 1911, 93) ; it was, however, found again, together with *Monacha cartusiana* (Müller), by Niels Petersen in 1915 at the fortress of Charlottenlund, north of Copenhagen (Schlesch 1916, 61 ; 1934, 39–42). The species still thrives there (I was lucky enough to find a single sinistral specimen, 15 July 1933). It was introduced by me at the railway viaduct at the Lyngby lake and the slope of the railway at Ryvangen in Copenhagen ; it is found on the railway at Herlufsholm near Næstved in South Zealand, and was introduced into a garden in Stege on Möen by Niels Petersen, where it still lives. A small colony of this species was found in 1887 near Helsingborg in Scania (Holmqvist 1917, 140) and a single specimen on Bygdö near Oslo (Esmark 1886, 106), apparently the same specimen, with M. Sars's handwriting on the label (Ökland 1925, 121), mentioned by E. v. Martens (1857, 89). *H. itala* occurred already in 1845 at Plön in Holstein (Herrmannsen) and is now scattered through the north German lowlands (e.g. Rüdersdorf near Berlin, Landsberg on the Warthe, also Ludwikowo near Poznań (Urbański 1936, 8), and in N.E. Bohemia at Turnau on the Iser and Lobesitz on the Elbe (Ehrmann 1933, 124), but the natural northern area of distribution runs along the central German mountains. Finally there are the very interesting occurrences of species of *Helicella* on the East Baltic islands of Öland and Gotland. On Öland *H.* (*Helicopsis*) *striata* (Müller) occurs widespread on the Silurian limestone called " Alvaret ", from at least Borgholm southwards, first found by P. B. Fries, 1822. This species in several places in Poland and Germany seems to be in decline (Ehrmann 1933, 121 ; Urbański 1948, 93), but is found isolated in southern Poland at Korytnica and between Pinczów and Skowronne near the Lysa-Góra Mountains (Holy Mountains), while the records for Hungary, Bulgaria, etc., belong to nearly related species [*H.* (*Helicopsis*) *hungarica* Soós & Wagner, *H. cereoflava costulata* (C. Pfeiffer)] ; also in Brandenburg at Küstrin and along the river Oder and in some places in Brunswick. This species is dispersed more evenly along the northern edge of the central German mountains as far eastwards as Bernburg (province of Saxony) and Coburg, but is wanting in the former kingdom of Saxony and in Silesia and is apparently wanting in the Main valley and in the Franconian Jura in northern Bavaria ; it appears, however, in the Elbe region in Bohemia in the central, northern and north-eastern parts. As already pointed out by me (Schlesch 1946, 84), the occurrence on Öland and Gotland must be a survival. S. Jaeckel sen. mentioned also *H. striata* from

Nowo-Alexandrowsk (Zarasai) in N.E. Lithuania, but this record seems to be erroneous.

Concerning the occurrence of *H.* (*Helicopsis*) *geyeri* Soós in northern Gotland as stated by Hubendick (1947, 75), I am of the opinion that this interesting phenomenon must be more closely examined. Dr. Hubendick very kindly sent me his single specimen found dead in 1942 on the islet of Aurgrund outside Fårön, and undoubtedly this specimen in some respects looks like *H. geyeri.* Lohmander found at Fleringe in northern Gotland some specimens which he first referred to *H. striata* (*Göteborgs Museum Zoologiska Avdelningen*, Berättelse för år 1943 (1944) 14). In addition there are 3 specimens from Grötlingbo in central Gotland which Hans Kauri sent me, which were unfortunately dead and not full-grown; nevertheless I am able to ascertain that they differ in several respects from *H. striata* and typical *H. geyeri*, which I have from the type locality, Gotternscher Herzberg near Bothenheilingen at Langensalza (legit W. Boeckel) and from Hammelburg in northern Bavaria (leg. L. Hässlein). Though *H. geyeri* is undoubtedly more widely dispersed but mistaken for other species, it is necessary to be cautious in identifying this species merely from the characters of the shell; thus R. Lais (1930, 104–109) gave *H. geyeri* in Graubünden, the Tyrol and neighbourhood of Vienna. Forcart (1934, 148–149), however, made anatomical examination of material from Graubünden and found the specimens to belong to *H. candidula.* As I possess material from Graubünden sent me by Dr. Forcart, I am able to state that, though they deceptively resemble *H. geyeri* both in size and shape, the shell has more regular and delicate striation in contrast to *H. geyeri* from Thuringia, which have a rougher and irregular striation, but the main point in deciding this question concerning the Gotland species is whether they possess 2 stunted bursae copulatoriae and lack an appendicula, unlike the subgenus *Candidula*, which only possesses a single bursa copulatoria (Hesse, *Archiv für Molluskenkunde* 1926, 113).

REFERENCES.

AILLY, A., 1907. En för Sverige ny snäcka, *Helix obvia* Hartm. *Fauna och Flora* **2**, 171–173.

BAUME, W. LA, 1914. Über das Vorkommen von *Helix obvia* (Ziegl.) Hartm. (*candicans* Ziegl.) in Westpreussen und Posen. 37 *Bericht Westpreuss. Botan.-Zoolog. Ver. Danzig*, 341–344.

BERNSTRÖM, J., 1935. Om en för den svenska faunan ny snäcka, *Helicella* (*Candidula*) *candidula* Studer. *Fauna och Flora*, 264–268.

EHRMANN, P., 1933. Mollusken (BROHMER, EHRMANN & ULMER, *Die Tierwelt Mitteleuropas* **2**, 1).

EMEIS, W., 1920. *Helicella obvia* Hartm. bei Rendsburg. *Arch. Moll.* **52**, 95–96.

ESMARK, B., 1886. On the Land and Freshwater Mollusca of Norway. *J. Conchol.* **5**, 90–131.

FORCART, L., 1934. *Helicella geyeri* Soós in Graubünden. *Arch. Moll.* **66**, 147–149.

HOLMQVIST, E., 1917. Fund von *Helicella ericetorum* (Müller) in Schweden. *Nachrichtsbl. Deutsch. Malak. Ges.* **49**, 140.

HUBENDICK, B., 1947. *Helicella geyeri*, en för Sverige ny landsnäcka. *Svensk Faunistisk Revy* **3**, 75–76.

—— 1948. On northern isolated occurrences of certain terrestrial molluscs in the Baltic area. *J. Conchyl.* **88**, 145–149.

JAECKEL, S. junr., 1949. Die Helicellen in Schleswig-Holstein. *Schrift. Naturwiss. Ver. Schleswig-Holstein* **24**, 62–64.

LAIS, R., 1930. *Helicella geyeri* Soos in Graubünden. *Arch. Moll.* **62**, 104–109.

MARTENS, E. V., 1857. Ueber die Binnenmollusken des mittleren und südlichen Norwegens. *Malakozool. Blätter* **3**, 69–117.

MÖRCH, O. A. L., 1864. Fortegnelse over de i Danmark forekommende Land-og Ferskvandsblöddyr. *Videnskabelige Meddelelser naturhist. Forening Köbenhavn* **20**, 265–367.

SCHLESCH, H., 1916. *Helix* (*Helicella*) *candicans* Ziegler and *Helix* (*Theba*) *carthusiana* Müller in Denmark. *Naturalist*, 61.

—— 1934. Kleine Mitteilungen X. *Arch. Moll.* **66**, 29–49.

—— 1934. Revidiertes Verzeichnis der dänischen Land- und Süsswassermollusken und ihrer Verbreitung. *Arch. Moll.* **66**, 233–312.

—— 1942. 3. Nachtrag zu " Revidiertes Verzeichnis der dänischen Land-und Süsswassermollusken und ihre Verbreitung ". *Arch. Moll.* **74**, 104–113.

—— 1943. Zur Molluskenfauna Möens. *Arch. Moll.* **75**, 165–186.

—— 1946. On the occurrence of south-eastern elements in the land snail fauna of the Eastern Baltic area. *Proc. Malac. Soc. London* **27**, 84–87.

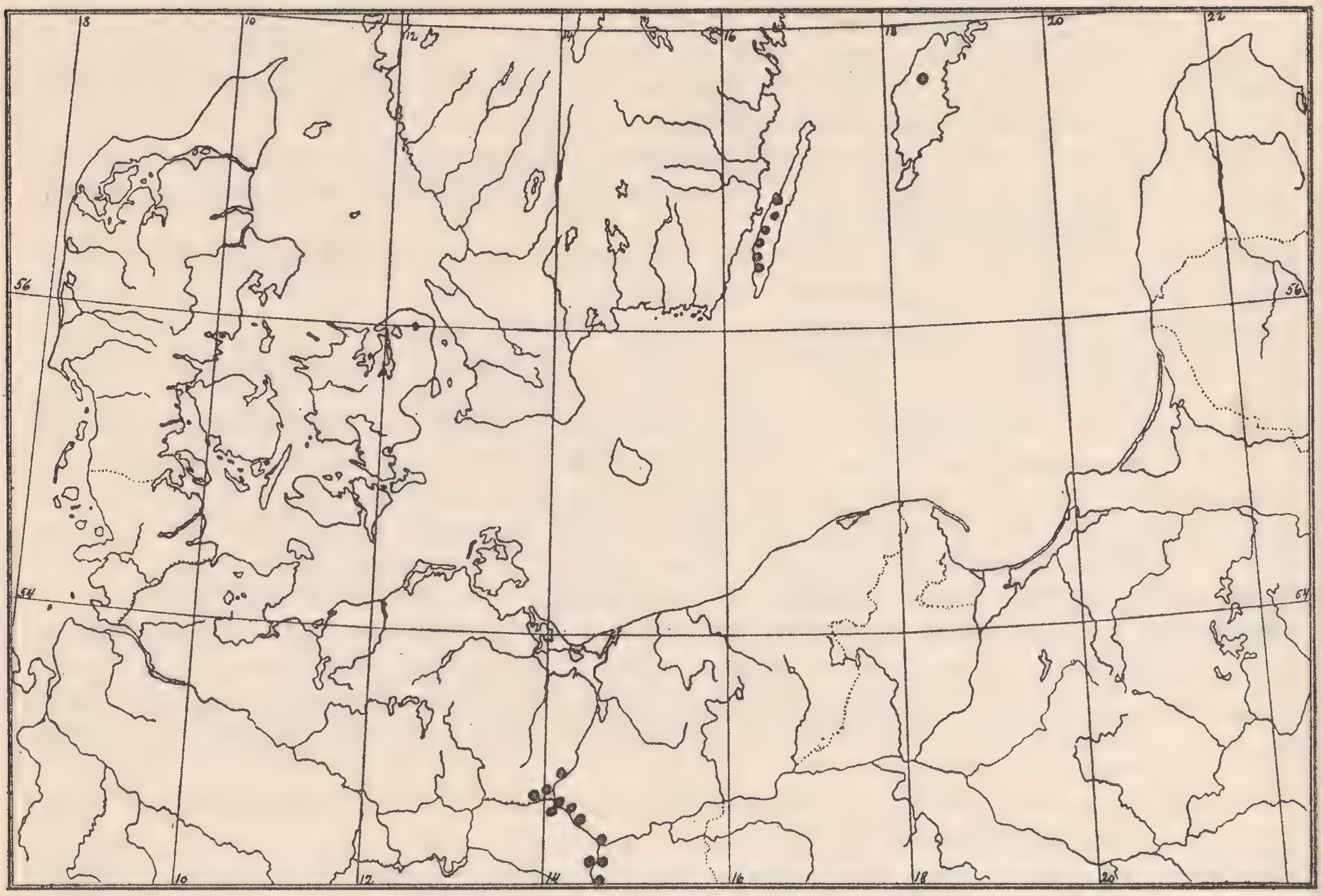
STEENBERG, C. M., 1911. Blöddyr 1. Landsnegle. *Danmarks Fauna* **10**.

URBAŃSKI, J., 1933. Beiträge zur Kenntnis der Molluskenfauna der Wojewodschaft Poznań. *Fragmenta Faunist. Mus. Zool. Polon. Warszawa* **2**, 63–95.

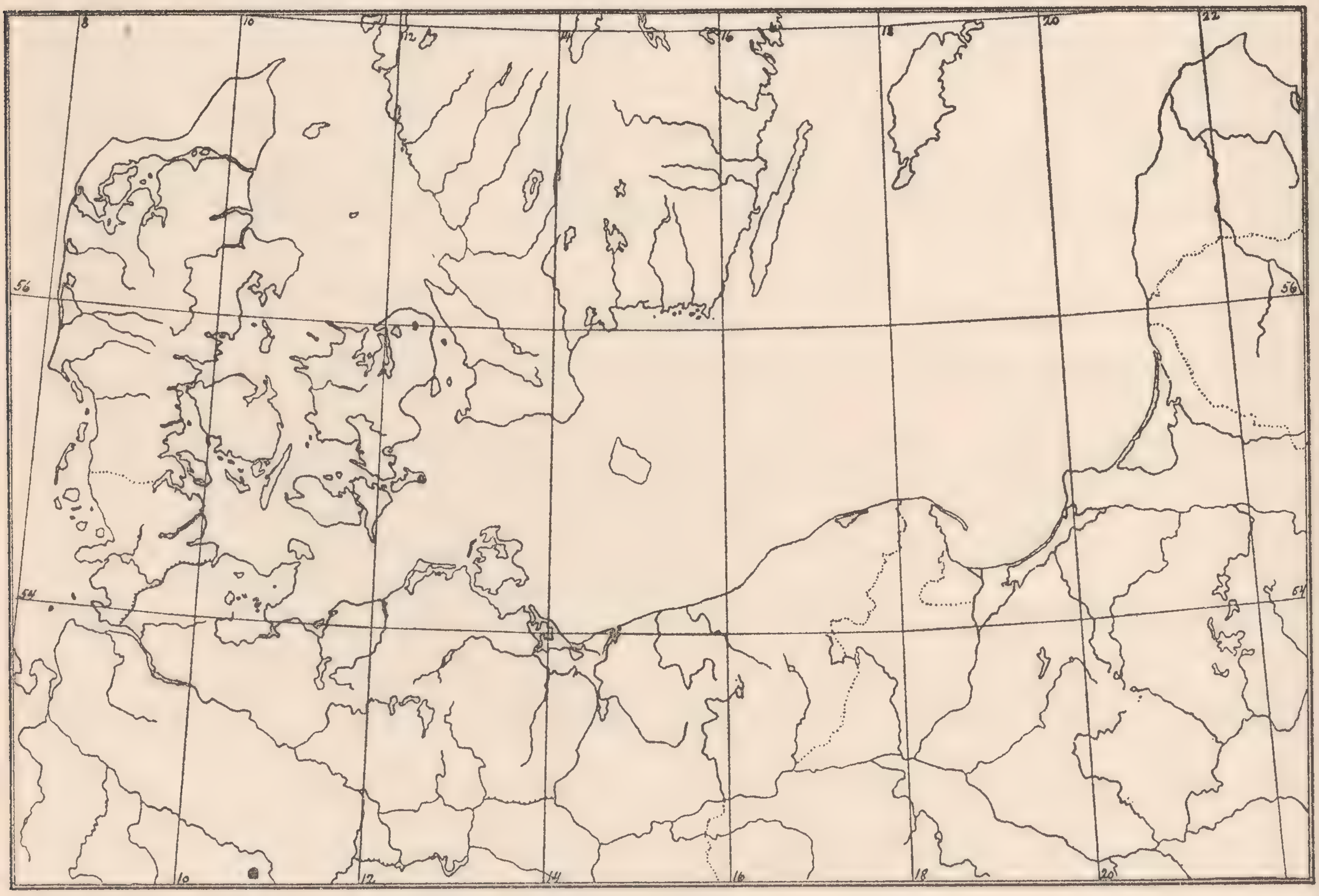
—— 1936. Szkik Fizjograficzny Wielpolskiego Parku Narodowego pod Poznańiem. *Wydawnictwo Oddzialu Poznańskiego Ligi Ochrony Przyrody Poznań*, 1–11.

—— 1948. Relict molluska in Poland and in some of the adjacent lands. *Ochrony Przyrody Kraków* **18**, 66–95.

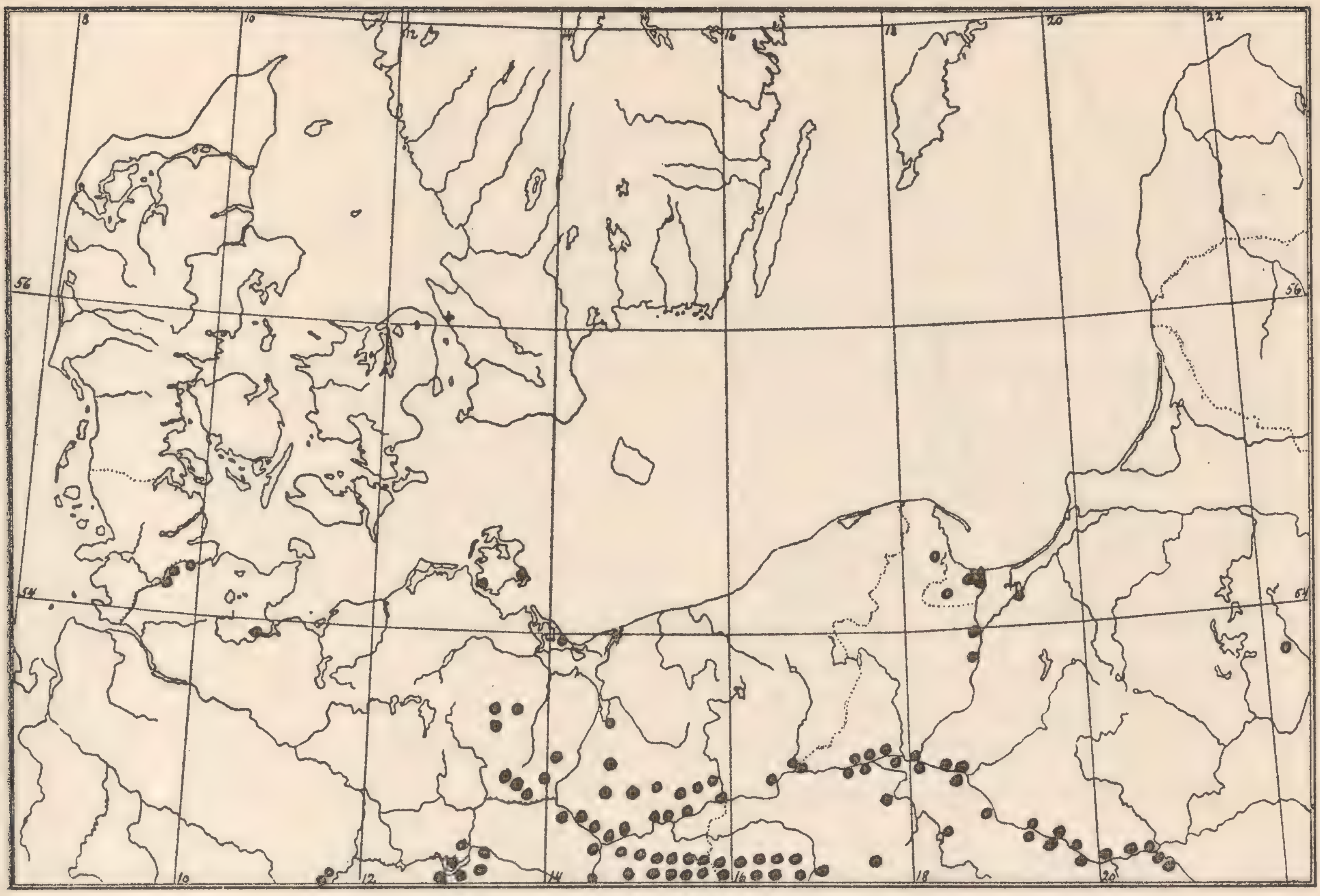
ÖKLAND, F., 1925. Die Verbreitung der Landgastropoden Norwegens. *Norske Vidensk.-Akad. Oslo* **8**.



Helicella (*Helicopsis*) *striata* (Müller).



Helicella (*Candidula*) *gigaxii* (Pfeiffer).



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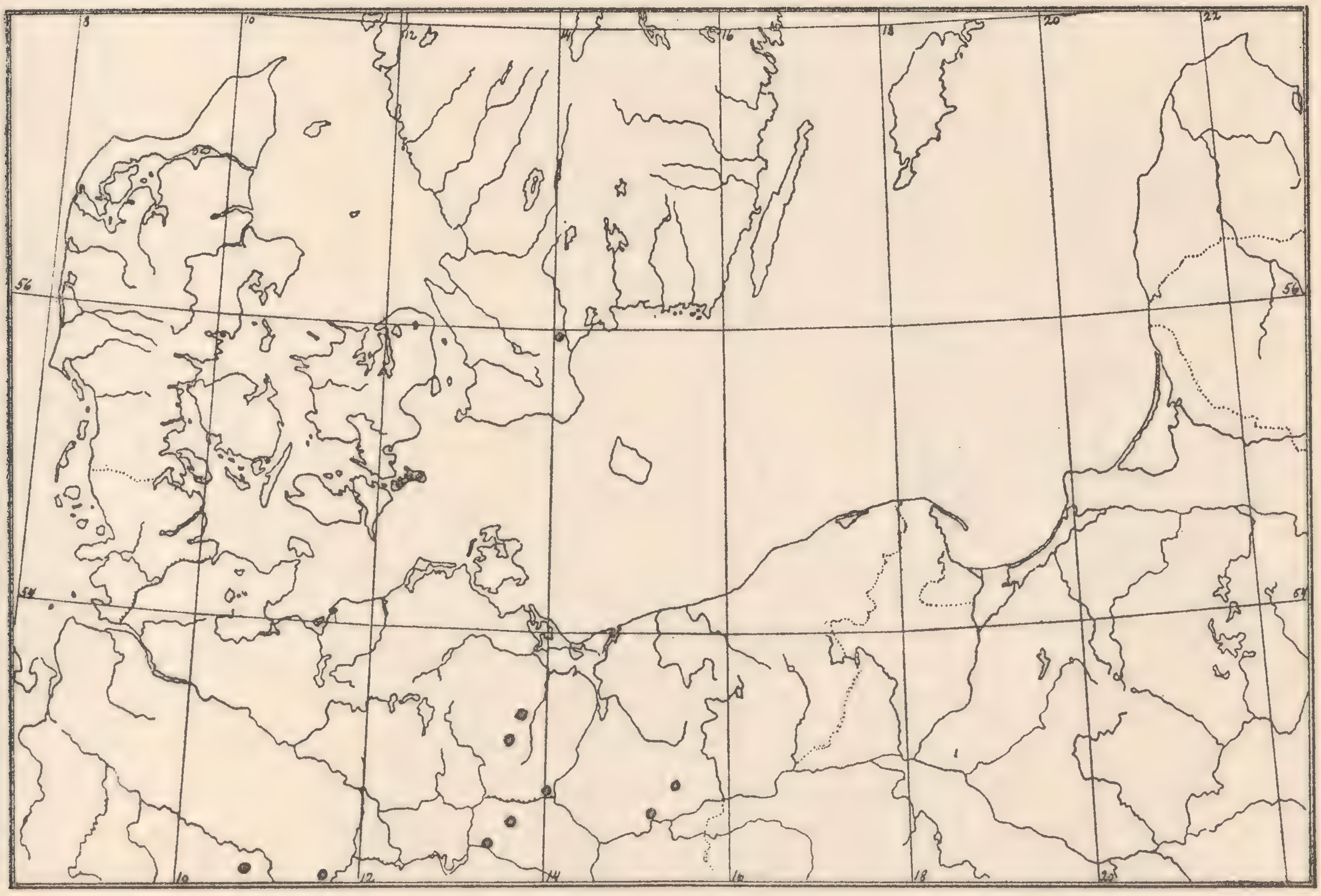
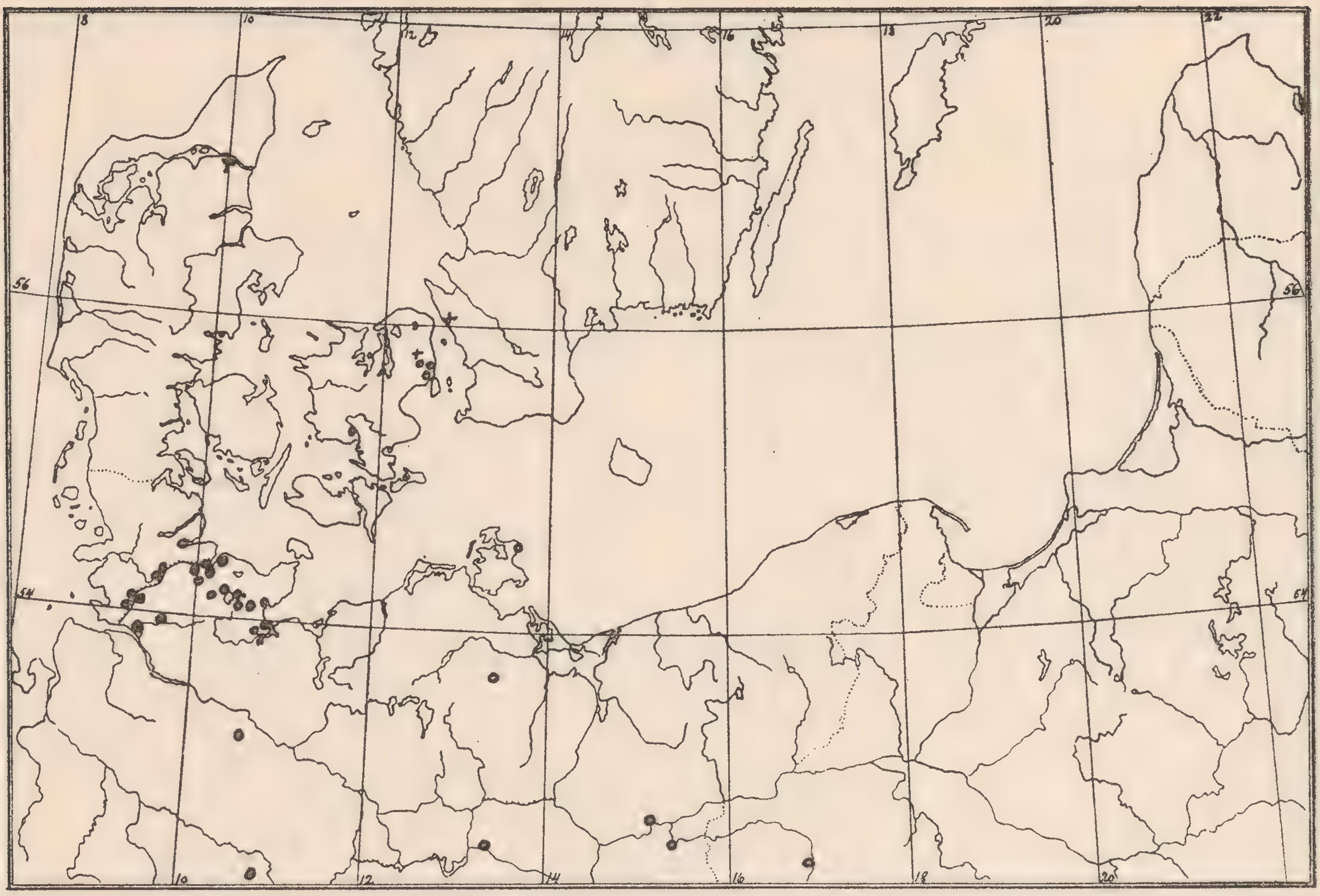
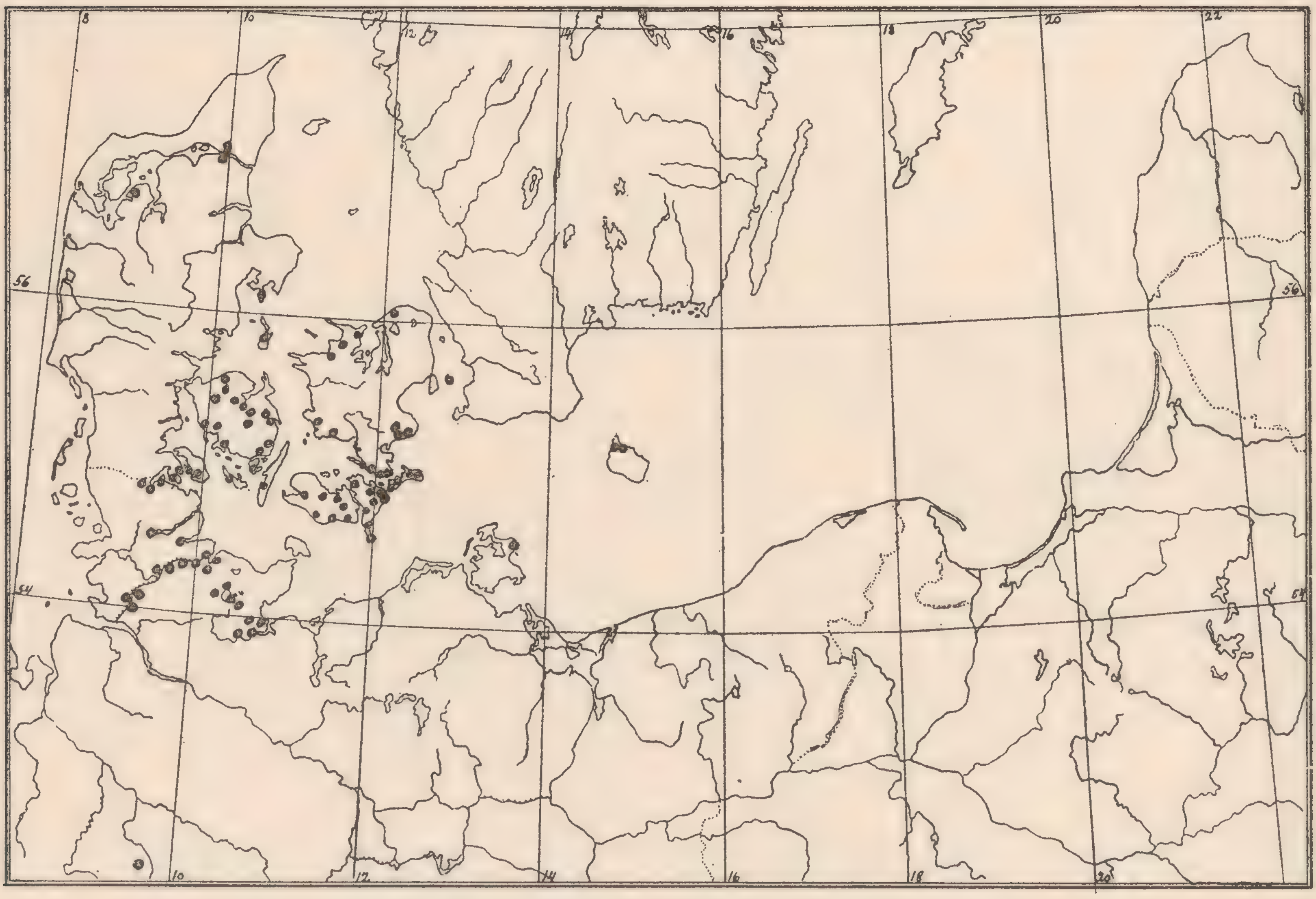


Helicella (*Candidula*) *candidula* (Studer).



Helicella (*Helicella*) *itala* (L.).



Helicella (*Candidula*) *caperata* (Montagu).

POMACEA HANLEYANA (ALDERSON).

By T. Pain.

(*Read before the Society*, 21 *October* 1950.)

The somewhat complicated history of this species has been dealt with at considerable length by Alderson (1926, 42). He was not, however, aware of its true habitat, but suggested (1925, 27) the Amazon River as most likely.

Unfortunately examples of this species have always been rare in collections and none of those available to the present writer bore any mark of locality, except that figured by Alderson (1925), said to come from Guiana, presumably the British Territory. This is, however, a most unlikely locality for which there is no confirmation whatever. Alderson himself considered it to be " probably a mistake ".

Through the kindness of Dr. J. C. Bequaert I have been able to examine some examples of *Pomacea* collected in the Quatipuru River at Braganza, State of Para, Brazil (P. Rosado), which, after careful comparison with the shells figured by Alderson (1925), I am satisfied represent *P. hanleyana.* It would appear therefore that Alderson's suggested locality, the Amazon River, was in the main correct.

Since numerous figures of *P. hanleyana* already exist—Alderson (1925, pl. 8), Hanley (1854–8, pl. 1) and Reeve (1856, fig. 128), and the specimens from Braganza do not differ materially from them except in size, it has not been thought necessary to figure these also. Only Reeve, however, gives any description of it, from a shell in Hanley's collection, presumably the type, although Alderson (1925) considered this doubtful. Reeve's description, like so many in *Conchologia Iconica*, is very brief, but most of the important features desirable for purposes of identification are described therein. It should perhaps be added that the colour of the lip, columella and parietal callus varies from white, through ivory-yellow to madder-red. All examples are however characterized by their bold oblong-ovate form and continuous encircling of narrow bands.

In spite of its strikingly individual appearance, *P. hanleyana* seems occasionally to have been confused with the quite different *P. dolioides* (Reeve) from British Guiana (Pain 1950, 68), a similarly banded species, but with an unusually large and inflated body-whorl, with very deeply impressed sutures and a short spire, a complete contrast to the oblong-ovate form of *P. hanleyana*. The occurrence of *P. dolioides* beyond the Guiana coastal plain is extremely doubtful.

The operculum of *P. hanleyana* was apparently unknown to the previous authors who have dealt with the species, as no mention whatever is made of it. The following description is from a typical Braganza specimen. " Operculum horny, very thin and semitransparent, about twice as long as broad, lower side shiny, scar large, covering more than one-third of the total area. Inner edge very narrow, the outer surface sculptured with numerous concentric, irregular, wavy ridges radiating outwards from the nuculus, which is placed at about the middle of the columellar margin."

Since no dimensions have ever previously been given for this species, the following table has been compiled from material available to the writer. Hanley's type shell is unfortunately lost, but a specimen from the collection of G. B. Sowerby III, now in my possession, comes very close to it, both in appearance and dimensions; no locality is given.

MEASUREMENTS (*in millimetres*).

	Length.	*Width.*	*Aperture.*
(1)	86·5	69·0	55·4 × 36·5
(2)	86·0	71·0	68·5 × 39·0
(3)	66·0	53·0	48·5 × 28·0
(4)	63·0	61·5	46·0 × 28·0
(5)	54·0	42·0	42·0 × 24·0

No. (1) is from the collection of G. B. Sowerby III; (2) and (5) Alderson's figured shells; (3) and (4) specimens from Braganza.

The author is deeply indebted to Lady Iliffe for the use of Alderson's specimens and to Dr. J. C. Bequaert for the shells from Braganza.

REFERENCES.

ALDERSON, E. G., 1925. *Studies in Ampullaria.*
—— 1926. The *Ampullaria swainsoni* of Philippi, Hanley and Reeve. *Proc. Malac. Soc.* **18,** 42–43.
HANLEY, S., 1854–8. *Conchological Miscellany, Ampullaria,* pl. 1–4.
PAIN, T., 1950. *Pomacea* (Ampullariidae) of British Guiana. *Proc. Malac. Soc.* **29,** 63–74, pls. 6–8.
REEVE, L., 1856. Monograph of the genus *Ampullaria. Conch. Icon.* **10,** pls. 1–28.

***Agriolimax laevis* (Müller) feeding on mealy bugs.**—On 23 July 1950 Mr. M. J. Crichton, of the Zoology Department, Reading University, brought for identification some small slugs which he had observed on the leaves of Cape primrose (*Streptocarpus kewensis*) in a heated greenhouse at the University's horticultural station at Shinfield, Berks. The slugs were found to be *Agriolimax laevis* (Müller), which is not uncommonly found in greenhouses. Mr. Crichton saw one slug actually devouring living mealy bugs, *Pseudococcus citri* (Risso), on the leaves of *Streptocarpus*, and found that the insects were consumed in such numbers as greatly to reduce the infestation; slugs introduced into jars with the leaves rapidly destroyed the bugs. There appears to be no reference to slugs acting as predators of mealy bugs in the extensive literature on the subject.

H. E. QUICK.

(*Read before the Society,* 18 *November* 1950.)

THE MOLLUSCA OF ELSTREE RESERVOIR.

By L. W. Stratton.

(*Read before the Society*, 21 *October* 1950.)

Elstree Reservoir is situated on the southern border of Hertfordshire, and is divided into two parts by the Elstree–Watford Road, which forms the boundary between that county and Middlesex. The smaller part, which, for want of a better name, may be called the Annexe, is entirely in Middlesex. Members of this Society visited the Reservoir on 30 September 1950, so it seems appropriate to give some account of its fauna.

The Reservoir covers some 59 acres when full and was made at the end of the eighteenth century for the Grand Junction Canal Company, so is now about 150 years old. It is about 20 feet deep in the middle and is situated on the London Clay. It is now owned by the Colne Valley Water Company, and pumping causes the level of the water to vary considerably. Along the northern side is a high concrete wall, on the east there is a good deal of reedy vegetation to which the water reaches when the reservoir is full. On the south side is the road embankment, with a good deal of vegetation, and to the west is an irregularly shaped wood with many fine willows. There are also reed beds which penetrate the wood, and in places, when the water is high, it is difficult to decide where the lake ends and the wood begins. At these times a good deal of the wood is under water. The Annexe has a controlled outlet, so that it may be full of water when the Reservoir is low.

The earliest records I have are from Boycott's "Freshwater Mollusca of the parish of Aldenham" (Boycott, 1919). He says: "The Elstree Reservoir is a disappointing piece of water, yielding only eight species. . . . The paucity of species may in part be due to the lake being only about 110 years old, a view which is perhaps supported by the absence of *Succinea*, *Vertigo* and *A. laevis* from the reedy margin. But it seems that the lake itself is an unsatisfactory habitat. . . . The water is soft (25, 26 mg. of calcium per litre), always slightly turbid." He records *Lymnaea peregra*, *L. auricularia*, *L. stagnalis*, *Planorbis albus*, *P. leucostoma*, *Unio pictorum*, *Anodonta cygnea* and *Pisidium* sp.

In 1925–26 Boycott made a further survey of the waters of Aldenham (Boycott, 1930). He again lists eight species for 1915–16, but omits *Unio pictorum* and gives two *Pisidia—casertanum* and *nitidum*. For 1919 he records *Unio pictorum*, *Sphaerium corneum*, *Sphaerium* (*Musculium*) *lacustre*, *Pisidium subtruncatum* and *P. obtusale*, and for the Annexe *Planorbis corneus*, *P. complanatus* (= *planorbis*) and *P. vortex*, adding that they had just begun to spread through the connecting tunnel to the main Reservoir. By 1926 they were still restricted to that end of the lake. In 1925 he added *Planorbis nautileus* (= *crista*) to the list, making 17 species in all. Boycott writes: "Of the four fresh *Planorbis*, *vortex* and *nautileus* live in two ponds about half a mile off which communicate with the Reservoir by a running ditch which is seldom dry. The curious thing is that these same ponds and the ditch have been known for 11 years to contain four species (*Limnaea palustris*, *Planorbis contortus*, *Pl. fontanus* and *Paludestrina jenkinsi*) which have not spread into the Reservoir though as far as we know they might well live there. The Reservoir is now about 120 years old and it is tempting to suggest that the additions which have been observed in the last 10 years are items in its gradual colonization. *Succinea elegans* and *Zonitoides nitidus* have not yet reached the reed beds at the edge: both are common enough along the Colne three miles away."

No further records have come to hand until the writer investigated the Reservoir at intervals from 1945 onwards. One of the difficulties is the height of the water. When the Reservoir is full the south side is too deep, the western side is too deep in mud and the vegetation on the eastern side has no molluscan life at all. When the water is low there is a wide expanse of gravelly clay all round, the water at the edge, though relatively clear, is quickly clouded, so that the smaller species are not easily found. Throughout this period *Unio pictorum* has been abundant, *Lymnaea stagnalis* and *L. peregra* have been found at the southern end, and *Sphaerium lacustre* was found in debris. In 1946 *Planorbis vortex* and *Lymnaea palustris* were found among the reeds on the western side, the latter new to the Reservoir. All the Annexe species were still there, with the addition of *Lymnaea stagnalis* and *L. peregra.* The former were very interesting: those in the Reservoir were small and clean, those in the Annexe much larger, much more fragile and covered with algae. In 1949 *Anodonta anatina* was taken alive in the Reservoir, another new species.

The visit of 30 September 1950 was a memorable one for the writer. The water was low, the surrounding "beach" very sticky, but two more of Boycott's records were confirmed and two new species found. *Lymnaea auricularia* was found abundantly and a number of empty shells of *Anodonta cygnea*, the largest four inches long. Several *Lymnaea stagnalis* were found well along the eastern side, and hundreds of *Unio pictorum* were seen moving on the bottom, their tracks in the soft clay being very clear. Then *Hydrobia jenkinsi* was found on stones, not very many, but all along the eastern and northern sides. Finally, *Viviparus viviparus* was taken quite abundantly. All the live ones were small, but several well-grown dead shells were also taken. This is not only a record for Elstree, but also for the parish of Aldenham. The nearest known locality is the Grand Union Canal at Watford. Of 13 *Hydrobia jenkinsi* taken, all were the carinate form. As this did not appear to be a large enough sample to warrant any conclusion as to the prevalence of the keeled form, another visit was made on 7 October, and a further 98 snails were taken, all under stones on the north side. Of these, 82 were keeled and 16 smooth, so that in all 95 of 111 were keeled, or 85·6 per cent. There was a great deal of variation in the strength of the keel; in some it was broken up into short spines.

The occurrence of *H. jenkinsi* in the two ponds referred to is Boycott's only record for Aldenham. It now lives in the River Colne, though its numbers are very variable. Sometimes it occurs in thousands and sometimes it is difficult to find at all. Two batches were taken from flood rubbish in 1946 and 1947. In 1946, of 1,143, 4·5 per cent were keeled, and in 1947, of 229, 9·6 per cent were keeled (Stratton, 1948).

Since 1945 four new species have been added to Boycott's list for Elstree, making a total of 21 for this " unsatisfactory habitat ", and the range of other species has extended. It therefore seems reasonably certain " that these additions are items in its gradual colonization ".

In view of Boycott's remarks about *Zonitoides nitidus* and other land species, it is not inappropriate to say something of the land Mollusca found in the immediate vicinity. The wood on the western side of the Reservoir is not mentioned by him, either in his " Survey of the Land Snails of Aldenham " (Boycott, 1921), or in his notebooks. It is a " wet " wood, and good snailing is only possible when it is at its driest. In spite of this, 19 species have been found there, including *Zonitoides nitidus*. None occurs in great numbers, except perhaps *Carychium*, which includes both species, *tridentatum* being more numerous than *minimum*. The full list is as follows :—*Carychium minimum*, *C. tridentatum*, *Columella edentula*, *Lauria cylindracea*, *Acanthinula aculeata*, *Cochlicopa lubrica*, *Punctum pygmaeum*, *Discus rotundatus*, *Arion intermedius*, *Hygromia hispida*, *Helix nemoralis*, *Euconulus fulvus*, *Zonitoides nitidus*, *Retinella radiatula*, *R. nitidula*, *Oxychilus alliarius*, *Vitrea crystallina*, *Vitrina pellucida* and *Agriolimax reticulatus*.

The surrounding area, all on the London Clay, is a poor place generally for snails, though some interesting species occur. *Zonitoides nitidus* has, since Boycott's day, colonized the edges of a small pond some three-quarters of a mile north-east of Elstree Reservoir. All these are recorded in " A resurvey of the Land Mollusca of Aldenham " (Stratton, 1950).

REFERENCES.

BOYCOTT, A. E., 1919. *Trans. Herts Nat. Hist. Soc.* **17**, 163.
—— 1921. Ibid. **17**, 220.
—— 1930. Ibid. **19**, 5.
STRATTON, L. W., 1948. Ibid. **23**, 26.
—— 1950. Ibid. **23**, 100.

Crepidula fornicata (L.) in Tor Bay.—Mr. P. P. Milman (*J. Conchol.* **23**, 100) reports finding the slipper limpet at Paignton in January 1950. This is not, however, the first record from this part of the coast, as *C. fornicata* was found in the neighbourhood of Paignton in September 1946 and February 1947, and off Berry Head in February 1948, as recorded in the *Proceedings of the Dorset Natural History and Archaeological Society* **70**, 122 [see also *Proc. Malac. Soc.* **28**, 168].

W. D. LANG.

(*Read before the Society*, 18 *November* 1950.)

ANODONTA ANATINA (L.) IN NOTTINGHAMSHIRE.

By H. H. Bloomer.

(*Read before the Society*, 21 *October* 1950.)

Dr. J. O'N. Millott and Mr. G. W. Pitchford have kindly sent to me for examination samples of *Anodonta anatina* (L.) gathered by them in Nottinghamshire, and the shells show such a wide range of variation in shape and thickness that it is thought a description of them and the information concerning the localities will be of much interest.

Dr. Millott collected 8 shells in June 1949 from the River Leen at Papplewick, Notts.

He says the river, which rises in, and flows over, Triassic strata for the whole of its extent, passes through the lakes in Newstead Abbey Gardens before reaching Papplewick and though formerly joining the river Trent now enters the canal at Lenton. Trout and other fish are in the stream.

Determinations of the total, temporary and permanent hardness of the water, made in June 1949 by Mr. C. Dyson, B.Sc., gave the following figures :—

	Expressed as calcium carbonate parts per 100,000.	*Expressed as calcium carbonate mgm. per litre.*	*Expressed as calcium mgm. per litre.*
Total hardness . .	16·5	165	66
Temporary hardness .	3·7	37	15
Permanent hardness .	12·8	128	51

The low temporary in relation to the permanent hardness is a feature, the former being, of course, due to the bicarbonates of calcium and magnesium and the latter to the sulphates and/or chlorides of calcium and magnesium.

The shells are (1) 81 × 44 mm., var. *piscinalis* Nilsson ; (2) 100 × 50, a rostrate form of var. *piscinalis* ; (3) 98 × 50, a rostrate form of var. *piscinalis* with a thicker shell ; (4) 98 × 52, a thick shell : a somewhat ventricose and rostrate form of var. *piscinalis* ; (5) 78 × 43, an oval and, for the size, thick shell ; (6) 110 × 65, an elongate, rostrate and thick shell, incurved in the middle part of the ventral margin ; (7) 102 × 64, a moderately large and thick shell, relatively of considerable height. It is similar in shape to C. Pfeiffer's illustration of var. *ponderosa* (fig. 4, t. 4, *Natur. deut. L.-Süssw. Moll.*, 1825) ; (8) 73 × 40, a shell possessing some resemblance to *A. cygnea*, though with a thicker shell than is common for the size of this species ; however, there is no doubt that it is a form of *A. anatina*.

Furthermore, he included 4 specimens collected there in 1918–1919, (1) 115 × 60, a thick and elongate form of var. *piscinalis* ; (2) 90 × 46, another thick and elongate form of var. *piscinalis* with the umbones placed more anteriorly ; (3) 67 × 40, the dorsal edge anterior to the umbones very depressed ; (4) 90 × 57, a shell of an extraordinary shape, being moderately thick and of great height, the umbones prominent and situated more than usual towards the centre of the dorsal edge ; when the shell is viewed laterally it has a subrounded appearance.

Periostracum: the umbones when not decorticated are of a brown or olive colour: the other parts olive, brown or yellow of varying intensity but more often of a dark shade, with, at intervals, bands of dark to blackish-brown along the lines of growth. Generally the smaller shells are of a lighter and the larger ones of a darker colour.

Mr. Pitchford's sample consisted of 14 live mussels taken by him in August 1950 from Vicars Water, Clipstone, Notts.

He states that the pool is approximately 400 yards long and 250 yards at the widest part; it is shallow at the sides and deepens towards the centre, and is fed by a spring and a small stream: another small stream flows from it to the river Maun, and there are colliery dumps in the immediate vicinity. The bottom of the pool is of a stony nature and, although very little aquatic vegetation was seen in the water at the time, different kinds of fish are there; *A. anatina* is plentiful, and *A. cygnea* is also present.

Determinations of the total, temporary and permanent hardness of a sample of this water, made in October 1950 by Mr. C. Dyson, gave the following figures:—

	Expressed as calcium carbonate parts per 100,000.	*Expressed as calcium carbonate mgm. per litre.*	*Expressed as calcium mgm. per litre.*
Total hardness . .	55·3	553	221
Temporary hardness .	7·8	78	31
Permanent hardness .	47·5	475	190

The most interesting feature is the high permanent hardness figure.

In the sample are three mussels (♀, 114 × 61; ♂, 117 × 60; ♂, 117 × 61 mm.) the shells of which would pass for ordinary specimens of var. *piscinalis*; one (♂, 111 × 63), a heavier form of var. *piscinalis*; one (♂, 121 × 60), a rostrate form of var. *piscinalis*; two (♀, 107 × 54; ♀, 115 × 66) of a ventricose form of var. *piscinalis*; one (♀, 117 × 65) of a ventricose form of var. *piscinalis* with a comparatively greater height; one (♀, 114 × 67), a moderately thin shell and resembling in shape Pfeiffer's illustration of var. *intermedia* Lamarck (fig. 3, t. 5); one (♀, 127 × 69), a thick, but hardly massive, shell, which, notwithstanding the umbonal region and that part of the dorsal edge of the shell are in a measure depressed, more conforms in shape to Pfeiffer's figure 4, t. 4, of var. *ponderosa*; and another (♀, 124 × 73) thick shell with a broad anterior curve, and in which the anterior part of the shell has a greater height than the posterior portion. By having the live mussels I have been able to ascertain readily and to give the sex of each individual.

At my request Mr. Pitchford has also sent for inspection other specimens taken by him from the pool at the same time and two of them should be noticed. One (132 × 80), a nice specimen corresponding in shape to the before-mentioned form of var. *intermedia* but a much thicker shell; and the other (131 × 75) more allied to var. *ponderosa*: it is relatively not so thick and has a greater height.

The colour of the periostracum in the dorsal part of the shell is of various shades of olive followed by broad areas of olive or of a yellowish-brown of different intensity and merging into each other; at intervals there are bands of dark brown along the lines of growth, and these become nearly black towards the ventral edge, also on the dorsal part of the posterior half of the shell. The range and depth of colour varies from shell to shell.

None of the rostrate forms exactly agrees in shape with Rossmässler's illustration of var. *rostrata* (*Icon. L.-Süssw. Moll.* 1836, f. 284) and the shells are thicker than the described type.

The measurement of height is taken from the umbones to the ventral edge.

I wish to thank Mr. C. Dyson for his kindness in making analyses of the water from the river Leen and Vicars Water.

A NOTE ON THE DISTRIBUTION OF *ANODONTA CYGNEA* (L.), HAVING REGARD TO DIFFERENCES IN SEX AND GILL-STRUCTURE : II.

By H. H. Bloomer.

In my attempt to continue the investigation of the distribution of *Anodonta cygnea* I have not yet succeeded in obtaining any live individuals from either Lancashire or Yorkshire, but by the kindly help of Mr. G. W. Pitchford I have been able to extend the research into Nottinghamshire. He has sent samples from several localities and given the information concerning the pools.

Pool in the Japanese Garden, Newstead Abbey Grounds. A small pool fed by a stream from the Garden Lake and having an outflow connected eventually with the river Leen. The mussels were gathered in the centre, where the pool has a clay bottom covered by black mud and the water is 3 to 4 feet deep ; water lilies are plentiful. In the adjacent pools connected with this pool are trout, chub and perch. The sample consisted of nine mussels gathered in August 1950. The shells vary in shape from an elongate form of the type to var. *zellensis* Gmelin, with a tendency for the larger ones to be ventricose. All are nice clean shells of a lighter shade of colour. Four measure 150 to 157, one 136 and four from 101 to 112 mm. in length.

All the individuals had glochidia in the outer gills with the glochidial shell more or less formed. The smears taken from the antero-dorsal part of the gonads disclose relict ova in that of each individual. Two of the larger ones are hermaphrodites, the smears showing both sperm-morulae and spermatozoa, whilst in those of the other two no male products can be detected. In the smear of the medium-sized one only sperm-morulae are to be seen. Of the smaller individuals three are hermaphrodites with sperm-morulae and spermatozoa much more plentiful in the smears than in those of the larger ones ; in that of the fourth one no male products are recognizable. The longer the time that has elapsed since the spawning season the more the surplus products tend to disappear and their presence in the smears becomes more restricted (Bloomer, 1946).

OSSINGTON HALL LAKE, close to the village of Ossington.

Owing to the condition of the lake a thorough search could not be made. One mussel, 135 mm., taken in August had the outer gills filled with embryos, the glochidial shell being unformed. The smear of the gonads show relict ova, a few sperm-morulae but no spermatozoa are to be observed with certainty.

VICARS WATER, NEAR CLIPSTONE. A description of this pool has previously been given, but it should be stated that these mussels were collected from another part of it where there is a depth of mud mingled with large pieces of rock. The sample was composed of thirteen mussels collected in October. The shells are near the type in shape with a trend in some to be a little elongate or rostrate, and the shell is thicker than usual for this species : the length ranges from 111 to 130 mm. : the periostracum is of a darker colour.

All the individuals except one possessed glochidia in the outer gills, some with the glochidial shell being either unformed or partly formed. Smears of the gonads of all the gravid individuals contain relict ova : the male products vary from being numerous in those of four individuals, far less plentiful in five, to a scarcity in two, and in one none can be discovered. If the individuals which disclose only a few male products in their smears are included as hermaphrodites then they will all come under this category, with the possible exception of the one in which male products cannot be determined. In the one individual not carrying embryos the outer gills are of a marsupial nature, but the gonads appear not to have ripened, as the smear contains very few ova and the presence of male products is indefinite.

POOL "LAWN" is about half a mile from Kings Mill Dam and in the neighbourhood of Sutton-in-Ashfield. It is approximately 500 yards long and 200 yards wide : an enclosed pool with no stream flowing in or out of it. The water was very low, but in the part the mussels were taken there is a layer of thick black mud ; aquatic vegetation, Elodea, etc. Fish, roach and stickleback.

The sample gathered in November contained eleven mussels ranging in length from 96 to 141 and averaging 116 mm. The shells differ in shape from near the type to a more elongate form and two approach var. *zellensis* : there is a proneness to have a broad anterior curve : the periostracum is of a lighter colour.

Ten of the individuals had glochidia in the outer gills with the glochidial shell formed, but in two cases a small part of the gills was unoccupied by glochidia, which on examination has the appearance of a non-marsupial nature. Sex-modification of the gill was discussed in a previous paper (Bloomer, 1934). Smears of the gonads reveal male and female products in fluctuating quantities similarly to those of the individuals described from Vicars Water. Nine of them can be classed as hermaphrodites : in one the sex-products are indeterminable.

The remaining individual, 114 mm., is a male. The smears of the antero-dorsal, central and ventral parts of the gonads show only male products, mostly sperm-morulae. The outer gills appear to be non-marsupial although in some parts there is modification of their structure: the interlamellar septa are generally narrow, moderately lacunar, and muscle fibres are scanty: the number of filaments between the septa varies from 10 to 20.

The interesting result of the examination of these Nottinghamshire samples of *A. cygnea* is the finding of a male in the pool " Lawn ". This is the only one at present discovered in the area, implying that the sex is scarce. Furthermore, it is the only one I have seen in the large number examined from north of the river Thames in the eastern half of England. Another feature is that so many of the individuals disclose the hermaphroditic sex-phase, suggesting that this is the chief means whereby fertilization is maintained.

Analogous conditions to those above described are to be found elsewhere and reference to them has already been made (Bloomer, 1949).

I want to thank Mr. Pitchford for his generous assistance in this investigation.

REFERENCES.

BLOOMER, H. H., 1934. On the sex, and sex-modification of the gill, of *Anodonta cygnea*. *Proc. Malac. Soc.* **21**, 21–28.

—— 1946. The seasonal production of spermatozoa and other notes on the biology of *Anodonta cygnea* (L.). *Proc. Malac. Soc.* **27**, 62–68.

—— 1949. A note on the distribution of *Anodonta cygnea* (L.), having regard to differences in sex and gill-structure. *J. Conchol.* **23**, 33–36.

***Bithynia alberti* Smith in Lake Kivu.**—Moore (*The Tanganyika Problem*, 1903, 129) reported finding in Lake Kivu " a small variety of *Planorbis*, a small *Bithynia* and *Melania tuberculata* ", besides one or two species of Unionidae. Schubotz only obtained *Planorbis choanomphalus* Martens and *Melanoides tuberculata* (Müller) (*Bull. Amer. Mus. Nat. Hist.* **53**, 580). In December 1950 Dr Hendrick found a number of shells of *Bithynia* (*Paranerita*) *alberti* E. A. Smith on the shore of Lake Kivu at Lushadu; no loving specimens were seen. Together with the *B. alberti* were large numbers of both pale and dark specimens of *M. tuberculata*, and a *Planorbis* which seems to be *P. adowensis* Bourguignat; the shells vary a good deal, but do not approach the description of *P. choanomphalus*.

BERNARD VERDCOURT.

(*Read before the Society*, 20 *January* 1951.)

LAND SNAILS OF A RESIDENTIAL AREA IN N.W. HERTFORDSHIRE.

By Bernard Verdcourt.

(*Read before the Society*, 18 *November* 1950.)

This note is based on specimens which were collected whilst I was working at Boxmoor in the N.W. tip of Hertfordshire. The freshwater species and the insects have already been reported on (*The Microscope* **6** (10), 259–263, 1947, and *Ent. Month. Mag.* **85**, 249–253, 1949). The first reference gives a map of part of the area. The areas examined are very small in extent and are situated in a rural residential area. They consist of a meadow bordering a small stream which runs parallel to the Grand Union Canal and a small garden-orchard in Green End Road. It is interesting to see what snails still survive in an area which has been disturbed by man but not irreparably so. The orchard contains beds of asparagus and other vegetables and ornamental plants, together with fruit trees with rough grassland beneath. At one end a large log lies beneath a hawthorn bush. Roads, houses and other more built-up gardens surround the orchard, so that all the fauna is derived from that originally present. At the other end of the orchard are a lodge and converted stables. Altogether 32 species have been discovered and this shows that quite a rich snail fauna can hold out against the activities of man. Dates are given in the following list and also an estimation of the state of growth of the animals. These help to give some idea of the life-histories.

Domestic Species.

Helix aspersa Müller : hibernating on lodge wall together with numerous young ones (25.3.46) ; young active (24.4.46). Some young ones have been observed to be attacked by the ant *Lasius niger* (L.).

Limax flavus L. : common about the lodge and stables, usually under stones during the day, but one half-grown one was active on a hot July afternoon. Always with at least a dozen mites.

No other species were seen on or in the house.

Species seen on roads.

Arion ater L. : two brownish-grey ones seen feeding on a squashed frog (24.10.46).

Helix aspersa Müller : occasionally seen on roads.

Arianta arbustorum (L.) : regularly seen on the path of Collet Road, on the side which is bordered by scrub and is not built up ; juveniles in the spring.

Species seen on railway embankments.

The portion of the main Midland Region line was examined where it forms a border to the meadow ; a mossy patch covering small coal was the most productive (23.3.46).

Cochlicopa lubrica (Müller) : fairly common.

Discus rotundatus (Müller) : fairly common.

Hygromia hispida (L.) : frequent.

H. striolata (Pfeiffer): scarce under bricks, including one subscalariform individual.

Arianta arbustorum (L.): one nearly adult.

Retinella nitidula (Draparnaud): adults and juveniles abundant; crop contents entirely plant material.

Oxychilus cellarius (Müller): few dead shells.

O. helveticus (Blum): scarce—only one seen alive.

Vitrina pellucida (Müller): few dead shells.

Species living by the stream and on the canal tow-path.

Carychium minimum Müller *s.s.*: juvenile at roots of *Scrophularia aquatica* (21.3.46).

Succinea putris (L.): juveniles with the last, and also active on fresh *Scrophularia* shoots (2.5.46).

Hygromia hispida (L.): with *Carychium*; also a flattened variety with pale body by stream (Oct. 1945).

Ashfordia granulata (Alder): on marsh plants by the stream (Oct. 1945 and Sept. 1946).

Monacha cantiana (Montagu): juveniles abundant on the dried leaves of butterbur by canal tow-path (1.4.46 and 17.9.46).

Helix nemoralis L.: a few adults with the last (1.4.46).

H. hortensis Müller: banks of the stream (Oct. 1945).

H. aspersa Müller: with last.

Euconulus fulvus (Müller): one under plank by the stream (23.7.46).

Zonitoides nitidus (Müller): two juveniles with last; crop contents of diatoms and filamentous algae.

Further along the canal in the Berkhamsted direction the following species were found under moss in a scrubby clearing by the tow-path :—

Cecilioides acicula (Müller): one dead shell.

Cochlicopa lubrica (Müller): common.

Retinella nitidula (Draparnaud): one.

R. pura (Alder): one.

Vitrina pellucida (Müller): one.

Species occurring in the orchard.

Each time the log was visited all the molluscs beneath it which could be observed were removed.

Vertigo pygmaea (Draparnaud): under log, 1 (31.10.45); 2 (15.5.46); 1 (10.7.46); 2 (16.7.46); 9 (17.7.46); 2 (22.7.46); 1 (16.8.46).

Columella edentula (Draparnaud): one adult and one nearly so under the log (16.7.46).

Vallonia excentrica Sterki: frequent in the least disturbed places and also under log (Jan. and Feb.).

V. costata (Müller): one hibernating in hollow asparagus stem—it had three mites in the umbilicus (23.9.46).

Cochlicopa lubrica (Müller): Under stone (29.3.46); on rubbish heap (6.5.46); adults under log (30.10.45 and 1.8.46); juveniles and adults under moss (20.11.45).

Punctum pygmaeum (Draparnaud): in undisturbed parts of orchard.

Arion circumscriptus Johnston: one under log (6.6.46).

A. ater (L.): a batch of 40 eggs believed to be of this species was found beneath the log (14.11.45).

A. hortensis Férussac: under log (15.2.46; 25.3.46; 26.6.46); after the very cold winter (17.3.47 and 1.4.47).

Helicella caperata (Montagu): in less disturbed parts of the orchard.

Hygromia hispida (L.): adult under log (1.4.47).

Retinella nitidula (Draparnaud): under log (30.10.45; 15.2.46); one laying eggs (25.3.46); two half-grown ones, crop contents included a *Macrobiotus* and bark fibres (5.11.46); adults (22.7.46); juveniles active (9.4.47).

Oxychilus alliarius (Miller): under log (15.2.46).

O. cellarius (Müller): under log, one which had eaten some insect food (15.2.46); one with only vascular plant and wood remains in the crop (22.3.46); ditto (5.9.46).

Agriolimax reticulatus (Müller): common under the log (15.2.46; 25.3.46; 6.6.46; 22.7.46), and after the cold winter (17.3.47).

Besides the species listed for the various habitats above, *Monacha cantiana* (Montagu) is common on grass stems and bushes at a height of one or two feet above the ground in most of the hedgerows and allotments. *Oxychilus helveticus* (Blum) (two-thirds grown individuals) were found on moist leaves on allotments (5.11.46).

OBITUARY.

R. WINCKWORTH, 1884–1950.

RONALD WINCKWORTH, the third and youngest son of Charles Trew Winckworth, surgeon, and Alice (*née* Braby), both originally from Horsham, Sussex, was born at Brighton 12 July 1884, and died at his home in South Norwood, Surrey, 6 September 1950. He entered Epsom College with a scholarship in 1896 and left in 1902. He took a prominent part in the Epsom College Natural History Society, of which he was secretary during his last two years at school. He became secretary of the geological section of the Society in 1899, and frequently read papers. An article by him on "The Geology of Brighton" appeared in the 9th *Report* of the Society, for the year 1897, page 46; this must be his first scientific publication. In *Report* No. 10, p. 81, is printed a summary of a lecture he gave on "Mineral Properties". He built up a representative collection of chalk fossils, and on his leaving school the Society deplored the loss of "a most energetic secretary in Winckworth, who for several years has done us good service" (*Report* No. 14, p. 57).

After some temporary teaching appointments (Cleveland House, Weymouth, 1902–03; Ascham House, Eastbourne, 1903–05; St. Bees School, 1905–06), he won an open exhibition to Jesus College, Oxford, where he read mathematics, graduating B.A. in 1910; he proceeded to the degree of M.A. in 1919. Winckworth rowed in his College VIII, and in his last year at Oxford was High Master of Jesus College Elizabethane Society. Between going down from the University and the outbreak of war, he held further teaching posts (Radley College, 1911; Wellington College, 1911; teacher of mathematics, Brighton Technical School, 1912–14). In August 1914 he joined the Navy as Seaman, R.N.V.R., being commissioned as Assistant Paymaster in March 1915 and later Paymaster Lieutenant, R.N.R. After a period of service in H.M.Y. *Medusa* on yacht patrol off southern Ireland and Orkney and in the North Sea, he was transferred to H.M.S. *Underwing*, a Q-boat, as Paymaster in charge: this ship was engaged mainly in convoy service, based on Gibraltar. He was in some other ships for short terms of service. The official designation Paymaster gives but an inadequate conception of Winckworth's naval service, for he became expert at gunnery and navigation and was the finest type of naval officer, inspired with an intense love of the sea and ships and a single-minded devotion to duty.

After the war, Winckworth spent a year as assistant at the Marine Biological Association's laboratory at Plymouth, and was then engaged in miscellaneous lecturing and teaching until 1922, when he became instructor in navigation at Pangbourne Nautical College for two years. In October 1924 he went to India to visit his brother, Colonel H. C. Winckworth (obituary in *J. Conchol.* **23**, 21), and travelled for six months in South India and Ceylon. In October 1925 he started work at the Royal Society on publications and as Librarian, becoming Assistant Secretary in 1932 and Assistant Editor in 1937. He retired in 1944 owing to heart trouble, acerbated by the strain of civil defence duties, but continued occasional work as consulting editor. Sir Edward Salisbury writes: "The high standard reached by the Society's publications during the past twenty-five years is in no small measure due to the assiduous care and attention he devoted to them and to his widespread knowledge of the scientific background, in particular on the biological side. His loyal assistance to the Society, the affectionate regard in which he was held and his happy personal relations with many of its Fellows will make his loss the more deeply felt." In August 1947 he went to the Seychelles Islands, together with Mrs. Winckworth, to stay with his brother in Mahé. For months he had eagerly looked forward to this holiday, but on 23 October his brother died, and the bereavement affected him profoundly. His own health was further impaired by the shock of the motor accident which hastened his brother's end.

Winckworth belonged to a number of learned societies: Linnean Society (Vice-President, 1945–47), Royal Geographical Society, Zoological Society, Marine Biological Association, Malacological Society (Editor 1928–47, President 1939–42), Conchological Society (elected 1913, Marine Recorder 1924–31, President 1930–31), and was a founder member of the Association for the study of Systematics in relation to general Biology and the Society for the Bibliography of Natural History. He was one of the four British men of science invited by the Musée d'Histoire Naturelle to attend the Lamarck bicentenary celebrations in Paris in June 1946, and he was again in Paris in July 1948 for the 13th International Congress of Zoology. Another side of his character found expression in

Freemasonry: he joined the Royal Clarence Lodge, 271, in 1919, was Master in 1928, and Provincial Grand Standard Bearer in 1937; he joined the Lennox Chapter in 1929, of which he was Principal in 1936 and 1949, becoming Provincial Assistant Grand Director of Ceremonies in 1939 and Provincial Deputy Grand Registrar in 1948.

Winckworth was not attracted by organized games or competitive sports, but was an enthusiastic oarsman and a strong swimmer, and was happy in any kind of small craft at sea. He was fond of skating and a tireless walker, delighting in long and strenuous tramps over downs, moors and fells, particularly in his beloved Sussex or the Lake District, which he knew intimately. He was gifted with an exceptional flair for languages, and took up the study of Sanskrit as a recreation while still at school; he was conversant with a number of European languages, and had considerable knowledge of Russian and some Indian languages. Although he took his degree in mathematics, he might equally well have graduated in ancient or modern languages or in natural science. Without any academic training in the subject, he could hold his own with any professional zoologist. Possessed of a phenomenal power of memory, his breadth of knowledge of a wide range of subjects was impressive: he might fairly be said to have known something about most things and everything about some things. Besides geology, Winckworth's early interests included astronomy and alphabets, and he made a collection of Echinoderms, which was presented to Brighton Municipal Museum. He named and arranged his brother's comprehensive collection of Indian butterflies, now in the Hope Department of Oxford University Museum, and had a small collection of British and Indian crabs.

Winckworth was acknowledged by conchologists all over the world as one of the foremost authorities of his time on marine Mollusca, more particularly those of European seas and the Indian Ocean. His collection of British marine shells, begun in 1911, was one of the most complete ever formed, most of the specimens, all neatly labelled with precise data and attractively displayed, having been taken alive by himself in shore-collecting or dredging all round the coast from Shetland to the Channel Islands. This collection, with which was incorporated the Mason collection purchased in 1924 (*J. Conchol.* **21,** 186), went to Liverpool Public Museums in 1939, where more than half of it was destroyed in an air raid two years later. Winckworth presented me with his collection of British non-marine Mollusca, which, incorporated with my own, is now in Epsom College museum. Even while serving in the Navy, Winckworth contrived to do a considerable amount of collecting, first in Orkney and later in Spain and Senegal. On his arrival at Plymouth after the end of the war, all his baggage, including the specimens collected while he was stationed at Gibraltar, was stolen and never retrieved. Winckworth's object in disposing of his British collections was to make room for the rapidly expanding collection of shells from India and the Indian Ocean, made by his brother and by himself, on his visits to India and Ceylon. This fine collection comprises large series of exactly localized specimens of nearly every species occurring in those seas, in many cases growth stages from young to adult being represented. Latterly Winckworth paid particular attention to Nudibranchs, of which he built up a considerable collection, supplemented with accurate drawings and copious notes. He proposed nearly 30 new specific trivial names and 8 generic names ; 9 species were dedicated to him by other authors.

Winckworth's contribution to natural science cannot be fully assessed from his published papers, numerous and important though these are, for his influence on the work of others was great. He was constantly in touch by personal contact or by correspondence with all the principal workers on Mollusca, and his profound knowledge of the phylum and extensive acquaintance with its literature were always made unreservedly available, often at the expense of much time and trouble to himself, to all who sought his assistance and advice. There was a time when he contemplated writing a book on British marine Mollusca, or doing a revision of or supplement to Jeffreys's *British Conchology*, but owing to pressure of other work and his later specialization on Mollusca of the Indian Ocean, this project, which he alone could have carried into effect, was shelved and finally, when his health broke down, relinquished. He did, however, publish a List of the Marine Mollusca of the British Isles, in his presidential address to the Conchological Society in 1931. Winckworth's List, universally accepted as the standard one for nomenclature, is the most widely used and generally useful of all his publications, and though emendations will doubtless have to be made from time to time (he himself has published several), it is not likely to be superseded for many years to come.

Winckworth possessed a very comprehensive library of books and periodicals dealing with Mollusca, besides masses of systematically filed reprints and manuscript notes, and card indices of shells and conchologists. He was as much interested in the bibliography and personalia of conchology as in the animals themselves, and knew every work and worker on the group. In commissioning him to write the articles on Mollusca for the new (1950) edition of *Chambers's Encyclopædia*, the editors showed acute discernment, for his knowledge was encyclopædic. As editor of the *Proceedings of the Malacological Society* for nearly twenty years, he set a standard which all editors should seek to emulate. The scheme adopted by the Conchological Society for the division of the British marine area into census areas was devised by Winckworth (*J. Conchol.* **16,** 152).

Winckworth married Margaret Wallace, of Edinburgh, 26 December 1926 ; she died in 1939. He married her friend, Alison Mary Cruickshank, of Musselburgh, 2 April 1943.

When composing an obituary it is conventional to observe the time-honoured maxim, *de mortuis nihil nisi bonum.* In writing of Ronald Winckworth this necessitates no suppression or misrepresentation, and those acquainted with him will be the last to impute any exaggerated eulogy to this very inadequate tribute to the memory of my old friend. That he was a very learned man his writings testify ; erudition extending far beyond the limits of his special subject was manifest in conversation. Endowed with a genius for friendship and singleness of heart, he saw nothing but the best in everybody and inspired affection and respect in all who knew him. With an utter indifference to money, he was generous often beyond what he could well afford and delighted in bestowing hospitality. By nature neat and methodical, all his work was characterized by meticulous accuracy and exhaustive thoroughness. Setting himself the highest standard, he expected the same of others, and while ever ready with encouragement or commendation, he was intolerant of anything slipshod or superficial. His keen sense of humour and unfailing goodwill made him the ideal companion, and it is an incalculable privilege to have shared the selfless friendship and wise counsel of this fine man.

A list of Winckworth's published papers, comprising between 60 and 70 titles, is to be published with an obituary in the *Proceedings of the Malacological Society*. With the exception of his youthful contributions to the *Reports* of the Epsom College Natural History Society, and a note on "A bluethroat off Norfolk in May" (*British Birds* **10,** 41), all his writings deal with Mollusca, with the bibliography and nomenclature of the phylum and with workers thereon. He was responsible for the classification and nomenclature of the Mollusca in *Plymouth Marine Fauna*, 2nd edition, 1931, and 3rd edition, now in preparation. A broadcast talk which he gave on "Collecting Sea Shells", 18 May 1938, was published in *The Wild Life Around Us*.

Winckworth's portrait forms the frontispiece of *Proc. Malac. Soc.* **25.** Obituaries appeared in *The Times*, 16 September 1950, *Nature* **166,** 673, and *The Epsomian* **81,** Dec. 1950, 32. Others will be published by the Royal Society (*Notes and Records*) and the Linnean Society.

NEW GENERIC NAMES PROPOSED BY R. WINCKWORTH.

J.C. = *Journal of Conchology* ; *P.M.S.* = *Proceedings of the Malacological Society.*

Arenomya, 1930 : *P.M.S.* **19,** 15.
Catriona, 1941 : *P.M.S.* **24,** 148 (= *Trinchesia* Ihering, 1879).
Clelandella, 1932 : *J.C.* **19,** 250.
Devonia, 1930 : *P.M.S.* **19,** 14.
Heteranomia, 1922 : *P.M.S.* **15,** 33.
Leucophytia, 1949 : *J.C.* **23,** 38.
Similipecten, 1932 : *J.C.* **19,** 250.
Zozia, 1930 : *P.M.S.* **19,** 15 (= *Azorinus* Recluz, 1869).

NEW SPECIFIC TRIVIAL NAMES PROPOSED BY R. WINCKWORTH.

babylonica (*Odostomia*), 1940 : *P.M.S.* **24,** 41.
cosmia (*Lienardia*), 1940 : *P.M.S.* **24,** 42.
crichtoni (*Turbonilla*), 1940 : *P.M.S.* **24,** 42.
elpis (*Dentalium*), 1927 : *P.M.S.* **17,** 168.
ferruginea (*Thyasira*), 1932 : *J.C.* **19,** 251.
gallensis (*Acmaea*), 1928 : *P.M.S.* **18,** 135.
gravelyi (*Lienardia*), 1940 : *P.M.S.* **24,** 43.
haddoni (*Acanthopleura*), 1927 : *P.M.S.* **17,** 206.
hanleyi (*Nucula*), 1931 : *P.M.S.* **19,** 280.

iatricus (*Chiton*), 1930 : *P.M.S.* **19,** 78.
indica (*Tricolia*), 1940 : *P.M.S.* **24,** 41.
jeffreysi (*Saxicavella*), 1930 : *P.M.S.* **19,** 15.
karachiensis, subsp. (*Patella*), 1930 : *P.M.S.* **19,** 80.
kis (*Amphithalamus*), 1931 : *J.C.* **19,** 146.
lebouri (*Clione*), 1932 : *J.C.* **19,** 251.
mahensis (*Acanthochitona*), 1927 : *P.M.S.* **17,** 207.
mannarense (*Dentalium*), 1927 : *P.M.S.* **17,** 167.
moorei (*Nucula*), 1931 : *P.M.S.* **19,** 280.
nitidosa (*Nucula*), 1930 : *P.M.S.* **19,** 14 (= *N. turgida* Marshall).
penetrans (*Acanthochitona*), 1933 : *P.M.S.* **20,** 318.
pistis (*Dentalium*), 1940 : *P.M.S.* **24,** 43.
prashadi (*Sepia*), 1936 : *P.M.S.* **22,** 17.
scotica (*Odostomia*), 1932 : *J.C.* **19,** 250.
thurstoni (*Stylifer*), 1936 : *P.M.S.* **22,** 18.
tomlini (*Yoldiella*), 1932 : *J.C.* **19,** 251.
wallacei (*Chiton*), 1927 : *P.M.S.* **17,** 206 (= *C. lamyi* Dupuis).

Two MS. names of Winckworth were published by Leloup, 1939 (*Bull. Mus. Hist. nat. Belg.* **15,** no. 33, 9) : *Squamopleura stratiotes* and *S. salisburyi.*

SPECIES NAMED IN HONOUR OF R. WINCKWORTH.

Octopus winckworthi Robson, 1926 : *Ann. Mag. Nat. Hist.* (9) **17,** 161.
Latiaxis winckworthi Fulton, 1930 : *Ann. Mag. Nat. Hist.* (10) **5,** 251.
Vesicomya winckworthi Prashad, 1932 : *Siboga Exp. Pelecypoda*, 153.
Solemya winckworthi Prashad, 1932 : *P.M.S.* **20,** 179.
Tellina winckworthi Salisbury, 1934 : *P.M.S.* **21,** 90.
Sepia winckworthi Adam, 1939 : *Bull. Mus. Hist. nat. Belg.* **15,** no. 32, 1.
Erosaria turdus winckworthi Schilder & Schilder, 1939 : *P.M.S.* **23,** 140.
Otinodoris winckworthi White, 1948 : *P.M.S.* **27,** 203.
Tropidophora winckworthi Fischer-Piette, 1949 : *J. Conchyl.* **89,** 126.

[The following species are dedicated to H. C. Winckworth :—
Ischnochiton winckworthi Leloup, 1936 (*P.M.S.* **22,** 51), *Pleurobranchus winckworthi* White, 1946 (*P.M.S.* **27,** 52), *Euselenops winckworthi* Satyamurti, 1946 (*P.M.S.* **27,** 76).]

A. E. E.

C. D. HEGINBOTHOM, 1874–1950.

CHARLES DAVID HEGINBOTHOM, son of Dr. and Mrs. Edmund Heginbothom, was born at Bruton, Somerset, 18 April 1874, and died at his home, Walden Lodge, Devizes, 18 June 1950. He was a pupil at King's School, Bruton, where he was contemporary with Mr. E. W. Swanton, from whom he derived his interest in land and freshwater shells. He came to Devizes in December 1892, to join the solicitors' firm of Messrs. Jackson and Jackson (now Jackson and Awdry), and retired in June 1936 ; he was appointed a tax commissioner in 1949. He married Elsie

McKay, 26 October 1910; she died in 1944. He leaves a son and a daughter, Mr. Denis and Miss Margot Heginbothom.

The following quotation is from the *Wiltshire Gazette*, 22 June 1950: "He was a born collector with an outstanding interest in natural history and an extensive knowledge in most of its branches. He made two collections of the land and freshwater shells of Wiltshire, one of which he presented to the Swindon Victoria Museum, the other remaining in his possession [bequeathed to the Wiltshire Archaeological and Natural History Society, Devizes]. He kept his own records of nearly every wild flower in Britain, and was an acknowledged authority on birds and butterflies and moths.

"With such interests Mr. Heginbothom became a valued member of the Wiltshire Archaeological and Natural History Society, serving on its committee for some years. It was not only to this body that he was able to give considerable assistance in natural history matters, for when approached by other organizations—nature tests for Girl Guides is a case in point—or by individuals, he was always ready with help and advice.

"Bellringing was another of Mr. Heginbothom's life-long interests and this took him throughout the Salisbury diocese and beyond. For 13 years he was chairman of the Devizes branch of the Diocesan Guild of Ringers. For many years he was a member of St. John's tower, Devizes, being also for long in the choir, and a ringer at St. Mary's. It was in connection with this work among the ringers, and the services held by them, that he first became licensed as a lay reader. He was then in demand for occasional services in country parishes, preaching regularly at Rowde and at Heddington among other churches, and for 20 years he held the position of a parochial reader with extension to the Archdeaconry of Wilts."

Heginbothom published two papers in the *Wiltshire Archaeological and Natural History Magazine*: "Wiltshire Mollusc Collectors" (**51,** 457–463) and "The Mollusca of Wiltshire' (**52,** 250–255); he also contributed a list of the shells to Mrs. M. E. Cunnington's book, *Woodhenge* (George Simpson and Co., Devizes, 1929). He was elected a member of the Conchological Society in 1943.

Miss Margot Heginbothom and Mr. C. W. Pugh, hon. secretary and librarian of the Wiltshire Archaeological and Natural History Society, have kindly supplied information for this obituary notice.

A. L. DARRAH, 1878–1950.

ARTHUR LEICESTER DARRAH, of Marple, Cheshire, died suddenly at Torquay, 14 June 1950. He had spent all his business life in connection with the firm of Baxendale and Co., Ltd., plumbers' merchants, of Thomas Street, Manchester, first as a partner and then as managing director of the private limited company. To quote from the *Daily Mail* (20 June 1950), he "forgot the cares of big business as a collector of rare butterflies and sea shells from all over the world". He was elected a member of the Conchological Society in 1923. He was a keen gardener and took pleasure in showing visitors round his well-kept grounds.

W. D. FISHER, 1889–1950.

WORDSWORTH DONISTHORPE FISHER was the son of the late Greeves Fisher (who was accustomed to spell his name phonetically Greevz Fysher), and inherited much of that vigorous personality's outlook on life and love of nature. He was educated at Leeds Grammar School, and joined the firm of Kingfisher, lubricator manufacturers. He was an active member and office bearer in local natural history societies, including the Yorkshire branch of the Conchological Society. Strongly individualistic in outlook, he was more interested in the theoretical aspects of science than in the more practical details of collecting. He had an independent frame of mind and refused to accept any doctrine, however authoritatively proclaimed, without submitting it to careful thought and argument. He leaves a widow, five children, and seven grandchildren.

Dr. H. C. Versey of Leeds University has kindly supplied the above particulars concerning his brother-in-law.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

698th Meeting, held at the British Museum (Natural History), 21 October 1950.

The President in the chair.

Members Deceased.

The President reported the deaths of A. L. Darrah, W. D. Fisher, C. D. Heginbothom and R. Winckworth.

Communications.

" *Anodonta anatina* (L.) in Nottinghamshire," by H. H. Bloomer.

" *Hygromia cinctella* (Draparnaud) at Paignton," by P. P. Milman.

" The North European *Helicella*," by Hans Schlesch.

" The Mollusca of Elstree Reservoir," by L. W. Stratton.

" *Pomacea hanleyana* (Alderson)," by T. Pain.

" A List of the Marine Mollusca of the British Isles: Additions and Corrections," by R. Winckworth.

" Census of Distribution of British non-marine Mollusca," by A. E. Ellis.

Exhibits.

Mr. C. P. Castell: British and Continental Pomatiidae, recent and fossil, from the British Museum Collection.

Mr. A. G. Davies: *Anodonta cygnea* and pearls, Kelsey Park, Beckenham.

Mr. T. Pain: specimens to illustrate his paper.

Mr. G. W. Pitchford: Unionidae and other land and freshwater shells from Nottinghamshire.

Dr. H. E. Quick: living *Acme fusca* and *Cecilioides acicula* from Mickleham, Surrey; embryos of *Limax maximus*, showing cephalic and caudal vesicles.

Mr. A. Smith: *Assiminea grayana*, Hessle, S.E. Yorks.

Mr. L. W. Stratton: freshwater shells from Elstree Reservoir.

699th Meeting, held at the British Museum (Natural History), 18 November 1950.

The President in the chair.

Election of Members.

Professor Dr. C. R. Boettger, Braunschweig (Niedersachsen), Zoolog. Institut, Pockelsstrasse 10*a*, Germany (re-elected).

Rev. Harry B. Herrington, Keene, Ontario, Canada.

Miss Margaret Maitland Howard, St. Katherine's, 36 Mulgrave Road, Sutton, Surrey.

Miss Helen Rhoden, Mus.Bac., 225 Ringinglow Road, Sheffield 11.

Sidney C. Richardson, 16 Brewster Street, Essendon, Victoria, Australia.

H. H. Sheppard, M.A., Little House, Bucknell, Shropshire.

Capt. F. W. Short, 19 Great South Road, Remuera, Auckland, S.E. 2, New Zealand.

Mrs. Alison M. Taylor, B.Sc., 33 Royal Oak Road, Quinton, Birmingham 32.

Dr. Adolph Zilch, Frankfurt am Main, Zenckenberg, Anlage 25, Zenckenberg Museum, Germany (re-elected).

Communications.

" *Planorbis acronicus* Férussac in a Holocene deposit in Surrey," by Miss M. Maitland Howard.

" Land Snails of a residential area in N.W. Hertfordshire," by Bernard Verdcourt.

" *Agriolimax laevis* (Müller) feeding on mealy bugs," by Dr. H. E. Quick.

" *Crepidula fornicata* (L.) in Tor Bay," by Dr. W. D. Lang, F.R.S.

" *Assiminea grayana* Fleming in the Humber," by Arthur Smith.

Exhibits.

Special exhibit : *Mya.*

The President : British *Mya*, including the actual specimens figured in Pennant's *British Zoology* **4**, pls. 40, 41 ; Meyer & Möbius, *Fauna der Kieler Bucht*, plate illustrating living *Mya arenaria.*

Mr. C. P. Castell : fossil *Mya* and allied genera from the British Museum collections.

Mr. A. E. Ellis : *Planorbis acronicus* from Otterway's Pit, Chertsey.

Mr. H. F. Jones : British *Mya.*

Mr. T. Pain : series of *Egeria* from West Africa.

Dr. H. E. Quick : drawings of the anatomy of *Helicella elegans* from Chaldon, Surrey.

Mr. L. W. Stratton : *Mya arenaria* and *M. truncata* from Southampton.

700th Meeting, held at the British Museum (Natural History), 16 December 1950.

The President in the chair.

Election of Members.

Brigadier Edward Aubrey Glennie, Seaton House, Shrublands Road, Berkhamsted, Herts.

Dr. Karl L. Pfeiffer, Rammelsberg, Kassel, U.S. Zone, Germany (re-elected).

Communication.

" The distribution of *Hygromia cinctella* (Draparnaud) at Paignton," by Dr. A. Comfort.

Exhibits.

The President : a selection of species of *Murex*.

Mr. C. P. Castell : *Bythinella steinii* (Martens) and *Segmentina micromphala* (Sandberger), Pleistocene, Cambridge, from the Kennard collection (see *Q.J. Geol. Soc.* **105**, 498) ; British and Continental Tertiary Muricidae from the British Museum collections.

Mr. A. G. Davis : a copy of Lhuyd's *Lithophylacii Britannici Ichonographia*, 2nd edition, 1760, with E. M. da Costa's bookplate.

Miss M. Maitland Howard : Holocene Mollusca from Otterway's Pit, Chertsey, Surrey.

Mr. T. Pain : silicified fossil (? Pleistocene) *Pila*, Cassanje, Angola ; photographs of Lamarck's types of *Ampullaria* (= *Pila*) in the Lamarck collection at Geneva.

701st Meeting, held at the British Museum (Natural History), 20 January 1951

The President in the chair.

Election of Member.

Max P. Rohan, L.D.S. (Eng.), Queen Street, Rose Hill, Mauritius.

Communications.

" *Bithynia alberti* Smith in Lake Kivu," by B. Verdcourt.

" A new name for *Segmentina micromphala* (Sandberger)," by C. P. Castell.

" A new species of *Pomacea* from Bolivia," by Dr. W. Blum and T. Pain.

Exhibits.

Special exhibit : *Helix* (*Cepaea*) *nemoralis* L.

The President : *H. nemoralis* from the collection of Capt. C. Diver.

Mr. C. P. Castell : darts of *H. nemoralis* from Holocene (Kennard collection).

Mr. A. G. Davies : *H. nemoralis* from Coombe-in-Teignhead, S. Devon; a large series of *H. nemoralis* from Elmers End, Beckenham, Kent.

Mr. A. E. Ellis : sinistral and scalariform *H. nemoralis* from Bundoran, Donegal (*ex* J. R. le B. Tomlin).

Mr. H. F. Jones : sinistral, scalariform and malformed *H. nemoralis.*

Mr. T. Pain : examples of all known species of *Gonyostomus* Beck ; specimens of *Pomacea* to illustrate his paper.

Dr. H. E. Quick : *H. nemoralis* from Wales ; *Anodonta minima* Millet and other Unionidae from R. Thames, Sonning.

FIELD MEETINGS.

Chaldon, Surrey, 6 May 1950. Leader, Mr. A. G. Davies. The main purpose of this meeting was to visit the site of the colony of *Helicella elegans* (Gmelin) discovered by Mr. Wilkins in 1931 (*J. Conchol.* **19,** 147) on White Hill, Chaldon. The site is a steep grassy coombe recessed in the escarpment, bounded on the south by Rockshaw Road, on the north by Pilgrim's Way, on the west by Hilltop Road and on the east by a public footpath. The 500 and 700 ft. contours pass through the colony, which is in a flourishing state, but does not seem to have spread. At present this locality is the only one known for certain in the British Isles. The colony at Kearsney, Kent, is reported to have been destroyed, though Kennard (*J. Conchol.* **18,** 280) states that a small colony was living a mile away ; in the Kennard collection are some specimens labelled Shepherdswell, which is five to six miles from Kearsney. *H. elegans* is recorded in the older literature by reputed authors from Cumberland, Cornwall, Northamptonshire (Thorpe Mandeville), and more recently from St. Margaret's Bay, Kent, but all these records remain unconfirmed. This species has a way of appearing unexpectedly ; for instance, in France new colonies have recently been discovered at Calvados (*Bull. Soc. Linn. Normandie* ser. 10, **7,** 83) and Le Havre (*Arch. Moll.* **73,** 51). Both these introductions are due to occupation of the sites by mounted troops during the war of 1914–18.

A. G. D.

Norbury Park, Mickleham, Surrey, 24 June 1950. Leader, Mr. A. E. Ellis. After heavy rain during the week, conditions for collecting were excellent. *Helix pomatia* was much in evidence, and numbers were seen pairing and egg-laying. Two dead shells of *Helicodonta obvoluta*, which has been known from this locality for over 60 years (*J. Conchol.* **22,** 99), were picked up, but no living example has so far rewarded collectors. A list of species from the woodland visited was published in 1942 (*J. Conchol.* **21,** 325), to which the following can now be added : *Cecilioides acicula* (Müller), *Retinella radiatula* (Alder), *Monacha cantiana* (Montagu), and dead shells of *Helicella itala* (L.) and *Helicigona lapicida* (L.), making a total of 43 species, including 3 represented by dead shells only.

A. E. E.

West Drayton and Yiewsley, Middlesex, 22 July 1950. Leader, the President. The party assembled at West Drayton station and proceeded along the Grand Union Canal. Only 13 species of freshwater Mollusca were taken, although most members had brought nets or scoops. This seems to indicate a decline in the number of species in this part of the canal, as there were more in the 1920's. *Viviparus viviparus* (L.) was most common, in all stages of growth ; *Lymnaea peregra* (Müller) was surprisingly absent. The following were also obtained : *Valvata piscinalis* (Müller), *Bithynia tentaculata* (L.), *Lymnaea stagnalis* (L.), *L. auricularia* (L.), *Planorbis planorbis* (L.), *P. albus* Müller, *Succinea pfeifferi* Rossmässler, *Anodonta cygnea* (L.), *A. anatina* (L.), *Unio pictorum* (L.), *Sphaerium rivicola* (Lamarck), *S. corneum* (L.).

G. L. W.

Aldenham, Herts, 26 August 1950. Leader, Mr. L. W. Stratton. The first discovery of note was that of a large number of *Milax sowerbii* (Férussac) in a rubbish heap opposite Blackbirds Farm. In Blackbird Wood the usual chalk-pit species were found, including *Pomatias elegans* (Müller), which in this area is restricted to the chalk escarpment on which this pit is situated. Two dead shells of *Helicigona lapicida* (L.) were also found ; many dead shells of this species have previously been found in this pit, but no living specimens. Abbey Wood was notable for the large number of *Arianta arbustorum* (L.), with several varieties, and fine dark brown *Hygromia hispida* (L.). The slugs *Limax maximus* L. var. *concolor* Pini and *Arion ater* (L.) vars. *albida* Roebuck and *plumbea* Roebuck were also taken. L. W. S.

The party was hospitably entertained to tea by Mr. and Mrs. Stratton at their home, and the evening was spent examining Mr. Stratton's extensive collection of non-marine Mollusca.

C. P. C.

Elstree Reservoir, Herts, 30 September 1950. Leader, Mr. L. W. Stratton. The water in the reservoir was very low, and the surrounding beach very sticky. Many *Unio pictorum* (L.) were seen moving about in the water. Other species found were *Viviparus viviparus* (L.), *Hydrobia jenkinsi* Smith, *Lymnaea stagnalis* (L.), *L. peregra* (Müller), *L. auricularia* (L.), *Anodonta cygnea* (L.) and *A. anatina* (L.) ; the first two species have not previously been recorded from the reservoir. In the wood, the greater part of which was under water, *Carychium tridentatum* Risso and *Arion intermedius* (Normand) were found, both being new records for the area. Some large specimens of *Anodonta cygnea* were taken in the lake in Hillfield Park.

L. W. S.

A NEW NAME FOR *SEGMENTINA MICROMPHALA* (SANDBERGER).

By C. P. Castell.

(*Read before the Society*, 20 *January* 1951.)

Planorbis (*Segmentina*) *micromphalus* Sandberger (1875) was proposed as a new name for *Planorbis nitidus* Braun, 1842 (*non* Müller, 1774). Sandberger's description and figures were based on material from the lower Pleistocene of Mosbach, Baden. The species has recently been recorded for the first time in the British Isles by Kennard (in Hollingworth, Allison, and Godwin, 1950, 498) from the Pleistocene of Cambridge. Sandberger's name is, however, preoccupied by *Planorbis micromphalus* Fuchs (1870), from the Pliocene (Pontian) of Hungary. Sandberger (1875, 700) refers to this species, but does not seem to have realised that it invalidates his own later use of the trivial name *micromphalus*. I therefore propose the name **Segmentina sandbergeri** for *Planorbis* (*Segmentina*) *micromphalus* Sandberger (*non* Fuchs).

References.

Fuchs, T., 1870. Die Fauna der Congerienschichten von Radmanest im Banate. *Jahrb. K.K. Geol. Reichsanstalk* **20**, 346, pl. 14, figs. 24–27.

Hollingworth, S. E., Allison, J., and Godwin, H., 1950. Interglacial deposits from the Histon Road, Cambridge. *Q. J. Geol. Soc.* **105**, 495–509.

Sandberger, F., 1875. *Land- und Süsswasser-Conchylien der Vorwelt*, 777, pl. 33, figs. 18, 19.

REVIEW.

Mollusques testacés marins de la Côte occidentale d'Afrique. MAURICE NICKLIS. Pp. 269; 464 text-figures. Paris: Paul Lechevalier, 1950. Price 2,800 francs.

THIS work, which forms volume 2 of the *Manuels Ouest-Africains*, is an excellent one, appealing to both the amateur and the specialist. The figures, drawn by the author, are extremely well done and conveniently placed on the same page as the relevant descriptions throughout the book. An unusual feature in a work of this nature is a general introduction to the Mollusca, including paragraphs on collecting, nomenclature and determination, which will prove of value to the general reader. A very full glossary of generic and specific names, and a complete list of species and varieties described, arranged in systematic order, are also included.

G. L. WILKINS.

LIST OF MEMBERS: ALTERATIONS.

Changes of Address.

ARKELL, A. J., O.B.E., Hillside, Ballinger, Great Missenden, Bucks.
BENSLEY, Lieut.-Col. C. J. F., Heatherlands, Grayshott, Hindhead, Surrey.
CURNOW, P. W., City Museum, Queen's Road, Bristol 8.
The NATURE CONSERVANCY, 91 Victoria Street, London, S.W. 1.
PAIN, T., 120 Haverstock Hill, London, N.W. 3.

Correction.

SWANTON, E. W., O.B.E., A.L.S., Museum Cottage, High Street, Haslemere, Surrey.

Members Deceased.

A. L. DARRAH, W. D. FISHER, C. D. HEGINBOTHOM, R. WINCKWORTH, A. P. GARDINER.

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Arthur Edwin Boycott

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Changes of Address

BURCH, Dr. T., 4206 Halldale Avenue, Los Angeles 37, California, U.S.A.
DYKE, F. M., B.Sc., Woodside, Worth, near Sandwich, Kent.
HUGGINS, H. C., 65 Eastwood Boulevard, Westcliff-on-Sea, Essex.
MACDONALD, R. R., B.Sc., 21 Heathfield Road, Cliftonville, Belfast.
PATON, C. I., 7 Cavendish Road, Sutton, Surrey.
PICKARD, E., 23 Westgate, Hale, Altrincham, Cheshire.
PRASHAD, B., D.Sc., Zoological Survey of India, Kaiser Castle, Benares Cantt, India.
RICHARDSON, D. N., Penn Hall, Stockton-on-Teme, Worcestershire.
VERDCOURT, B., East African Herbarium, P.O. Box 5166, Nairobi, Kenya.

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(7TH EDITION.)

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FOREWORD.

IT is now thirty years since the publication of the last edition of the Conchological Society's Census of the distribution of British land and freshwater Mollusca, and demands for a new edition have become increasingly insistent. Boycott was preparing a new edition, but the war prevented his successor, A. R. Waterston, from bringing the work to completion. The Society has kept a Census for 75 years, the first entries in the record books being dated 12 October 1876; before 1919 it was largely maintained by the enthusiasm and industry of Roebuck, though he was not actually Recorder for the whole of that period. His work was ably carried on by Boycott until shortly before his death in 1938, and the great majority of the entries in the record books since 1919 are in his handwriting. As the 1921 edition was a Roebuck Memorial number of the *Journal*, so it is fitting that the present edition should

NOV 1 5 1951

commemorate the services to the Society and to malacological science of Arthur Edwin Boycott. An obituary, with portrait, was published in this *Journal* (**21**, 58), and other references will be found in *Proc. Malac. Soc.* **23**, 109.

It is manifest that the Census cannot be the work of any one individual. The Recorder's function is to enter up the records, but the records themselves are due to the willing collaboration of numberless collectors. Their names are duly entered in the Census record books (of which there are 31) and published in the annual Recorder's report printed in the *Journal.* Without belittling the contributions of others, certain names may be singled out for special mention. Charles Oldham, a close friend of Boycott's, was chiefly instrumental in working out the distribution of the species of *Pisidium* in Great Britain, besides adding many records of other Mollusca. The Irish records are largely due to R. A. Phillips and A. W. Stelfox, the latter well-known as the foremost authority on *Pisidium* ; the Recorder is glad to express his appreciation of the generous assistance received from Mr. Stelfox. Our knowledge of the past history of the species and their geological distribution is mainly owing to the life-long researches of A. S. Kennard. Particulars of Continental distribution have been kindly supplied by Dr. Hans Schlesch, though space does not permit of full use being made of his notes. The late Mr. R. Winckworth constantly placed his wide knowledge of bibliography and nomenclature at the disposal of the Recorder. Mr. Hugh Watson has read the Systematic Conspectus and made many valuable suggestions ; to him the Recorder owes a special debt of gratitude for much information contained in his published papers and in correspondence. The Table of Geological Strata is based on information kindly supplied by Dr. A. T. Hopwood and Dr. L. R. Cox, F.R.S. The present and past Recorders have had the valuable co-operation of expert referees, to whom critical or doubtful specimens are submitted ; records of slugs and *Succinea* in recent years have been authenticated by Dr. H. E. Quick. The Census may be regarded as the production of the Society as a whole, and only the shortcomings of this edition should be laid at the door of the present Recorder, who has merely endeavoured to synthesize the labours of others, and craves indulgence for any errors and omissions.

The distribution maps are designed to indicate only the general range of native species ; details of comital and vice-comital distribution are given in the tables. Stippling indicates that the species has been recorded from post-glacial deposits in that area, but not living. In the case of sparsely distributed species, or those which occur at the boundary (e.g. river or canal) between two areas, the comital system of recording gives an exaggerated picture of their frequency, though the range, which it is the purpose of the Census to ascertain, is represented with tolerable accuracy. Except for a few critical or recently recognized species, the distribution of our non-marine Mollusca has now been very fully worked out, and the object for which the Census was instituted has been largely achieved. In an investigation of this kind, however, there can never be any finality.

VICE-COMITAL BOUNDARIES.

The division of the British Isles into counties and vice-counties follows the schemes devised by H. C. Watson for Great Britain and by Babington, later modified by Praeger, for Ireland. In many instances the modern administrative county boundaries depart from those of Watson's time, so that recent maps may be misleading. Mr. J. E. Dandy is preparing a volume on the Watsonian vice-counties, to be published by the Ray Society, and he has kindly supplied a summary of the vice-comital boundaries of Great Britain. Watson's names for the counties are adopted, even though this involves some inconsistencies : e.g. in most cases the name of the county town is used for the county without the suffix " shire ", while in some an abbreviation of the county name is employed, for example Wilts, Hants, Herts, Berks, Bucks, Hunts.

ENGLAND AND WALES.

1 & 2, Cornwall West and East : Carrick Roads, River Fal and Truro River up to Truro ; Buckshead road from Truro ; thence road (A.3076) via St. Erme to Carland ; road (A.30) from Carland via Summercourt to Fraddon ; road (A.39) from Fraddon via St. Columb Major to Wadebridge ; Camel estuary below Wadebridge.

3 & 4, Devon South and North : line from River Tamar at Dunterton, following parish boundaries south of Dunterton, Bradstone, Kelly, Marystow, Coryton and Bridestowe to Kitty Tor ; line of watershed over Dartmoor from Kitty Tor by Amicombe Hill, Great Kneeset, Hangingstone Hill and Wild Tor to Hound Tor ; line following parish boundaries from Hound Tor south of South Tawton, Spreyton, Bow, Colebrooke, Morchard Bishop, Woolfardisworthy, Puddington and Cruwys Morchard to bridge over River Dart at Worth ; road from Worth via Ford to Tiverton ; road (A.373) through Tiverton to Cullompton road and Grand Western Canal ; Grand Western Canal to Somerset border.

5 & 6, Somerset South and North : Rivers Parret and Yeo up to Ilchester ; road (A.303) from Ilchester via Sparkford, Holton and Wincanton to Dorset border.

7 & 8, Wilts North and South : Kennet and Avon Canal from Somerset border to old Berkshire border at Hungerford.

11 & 12, Hants South and North : road (A.30) from Wiltshire border to Stockbridge ; road (A.272) from Stockbridge via Winchester, Bramdean and Petersfield to Sussex border. Isle of Wight forms v.c. 10.

13 & 14, Sussex West and East : old Brighton–London road, i.e. road (A.23) from Brighton (Palace Pier) via Patcham to Pyecombe ; road (B.2036) from Pyecombe via Clayton and Hassocks to Ansty ; road (A.272) from Ansty to Cuckfield ; road (B.2114) from Cuckfield via Woodcroft, Slough Green and Staplefield to Handcross ; roads (A.23 and B.2125) from Handcross to Crawley ; roads (B.2125 and A.23) from Crawley to Surrey border. (The vice-comital boundary is not coincident with that between the administrative counties of West and East Sussex).

15 & 16, Kent East and West : Rivers Medway and Beult up to Maidstone–Cranbrook road (A.229) ; thence along this road via Staplehurst, Cranbrook and Hawkhurst to Sussex border. (16 includes the south-eastern part of London which was formerly in Kent.)

17, Surrey : includes the western part of London south of River Thames.

18 & 19, Essex South and North : road (A.121) from Hertfordshire border at Waltham Abbey to Epping Forest ; road (A.11) from Epping Forest to Epping ; road (A.122) from Epping via High Ongar and Writtle to Chelmsford ; River Chelmer (Chelmer and Blackwater Canal) from Chelmsford to River Blackwater at Maldon ; Blackwater estuary below Maldon.

21, Middlesex : includes London north of River Thames and west of Essex border.

25 & 26, Suffolk East and West : line of longitude 1° East of Greenwich. (Not coincident with the boundary between the administrative counties of East and West Suffolk.)

27 & 28, Norfolk East and West : line of longitude 1° East.

30, Bedford : includes the detached (Tetworth) portion of Huntingdonshire.

33 & 34, Gloucester East and West : River Severn from old Worcestershire border near Deerhurst to junction with Stroudwater Canal at Upper Framilode ; Stroudwater Canal and Thames and Severn Canal to old Wiltshire border at Thames Head Bridge.

39, Stafford : includes the detached (Dudley) portion of Worcestershire.

50, Denbigh : includes the detached portions of Flintshire.

53 & 54, Lincoln South and North : Foss Dike Navigation from old Nottinghamshire border (below Odder) to River Witham at Lincoln ; River Witham below Lincoln.

55, Leicester : includes Rutland.

59 & 60, Lancaster South and West : River Ribble from Yorkshire border to the sea. (60 does not include that part of Lancashire north-west of Morecambe Bay, which is in vice-county 69.)

61, York South-east : East Riding of Yorkshire.

62, York North-east : North Riding of Yorkshire east of a line formed by Rivers Swale and Wiske up to the bridge at Little Smeaton and continued to Durham border by the road (A.167) from River Wiske to Great Smeaton, by the Hornby road and by the stream running from this road to the southernmost loop of River Tees at Beverley Wood. (Includes also that part of the City of York east of River Ouse.)

63 & 64, York South-west and Mid-west : West Riding of Yorkshire, divided by Leeds and Liverpool Canal from Lancashire border to River Aire at Leeds and by River Aire from Leeds down to River Ouse. (64 does not include that part of the City of York east of River Ouse, which is in vice-county 62, nor that part of West Riding north of the Lune-Ribble watershed, which is in vice-county 65.)

65, York North-west : North Riding of Yorkshire west of the line defined above under vice-county 62 ; includes also that part of West Riding north of the Lune-Ribble watershed, the boundary running from Wold Fell over Whernside to Lancashire border at Green Hill.

67 & 68, Northumberland South and Cheviotland : River Coquet up to Linbrig, thence by the line of the watershed over Crigdon Hill, Ridlees Cairn and Golden Pots and along Gammel's Path to the Scottish border at Coquets Head.

69, Westmorland : includes north-west Lancashire (Furness), i.e. that part of Lancashire north-west of Morecambe Bay (Kent estuary).

SCOTLAND.

85, Fife : includes Kinross-shire.

86, Stirling : includes the detached portion of Dunbartonshire (Kirkintilloch and Cumbernauld).

87 & 88, Perth West and Mid : Tay-Forth watershed from Kinross border at Innerdouny Hill to Cruach Ardrain ; Tay-Clyde watershed from Cruach Ardrain to Argyllshire border at Beinn Laoigh. (87 includes Clackmannanshire.)

89, Perth East : divided from vice-county 88 by Rivers Tay and Garry up to Loch Garry, thence by Allt Shallain and Allt na Glaise up to Inverness-shire border at Carn 'ic Loumhaidh.

92 & 93, Aberdeen South and North : watershed west of Inverurie, from Banffshire border at Allt Sowan Hill over Correen Hills and Bennachie to Newbigging (south-west of Chapel of Garioch) ; road from Newbigging via Chapel of Garioch to Drimmies ; road (A.96) from Drimmies to Inverurie ; road (A.981) from Inverurie to Souterford ; road from Souterford via Sunnybrae to road (A.947) at Kingoodie ; road thence through Udny to Housieside ;

road (B.9000) from Housieside to Newburgh ; Foveran and Ythan estuaries below Newburgh.

95, Elgin : Morayshire, including a part of Inverness-shire formerly in Morayshire, comprising the portion of Duthil and Rothiemurchus parish west of River Spey, and the eastern portion of Abernethy and Kincardine parish.

96 & 97, Easterness and Westerness : Inverness-shire (excluding Western Isles), divided by the watershed between east and west Scotland, from Ross and Cromarty border at Loch Loyne to Bridge of Oich (north of Loch Oich), thence over Mullach a'Ghlinne and A'Bhuidheanach to Creag Ruadh and west of Loch Ericht to Ben Alder and Perthshire border at Beinn a'Chumhainn. (96 includes Nairnshire ; 97 includes that part of the Argyllshire mainland west of Loch Linnhe).

98, Main Argyll : Argyllshire excluding Western Isles, Kintyre and that part of the mainland west of Loch Linnhe.

100, Clyde Isles : Buteshire (Bute, Arran and the Cumbraes).

101, Kintyre : Kintyre (Cantyre) peninsula of Argyllshire south of Crinan Canal ; includes Gigha Island.

102, South Ebudes : Islay, Jura, Scarba, Lunga, Garvellachs, Colonsay, Oronsay and associated islets.

103, Mid Ebudes : Mull, Ulva, Iona, Tiree, Coll and associated islets.

104, North Ebudes : Muck, Eigg, Rhum, Canna, Soay, Skye, Scalpay, Raasay, South Rona and associated islets.

105 & 106, Ross West and East : Ross and Cromarty (excluding Lewis), divided by the watershed between west and east Scotland, from Sutherland border at Meall a'Bhuirich Rapaig (Cromalt Hills) over Clar Lochan, Cnoc a Choilich, Mullach a'Bhrian Leitir, Seana Bhraigh, Beinn Enaiglair, Beinn Liath Bheag, Sgurr Mor, Groban, Fionn Bheinn, Carn Beag, Moruisg, Beinn Dronaig and An Cruachan to Inverness-shire border at Sgurr nan Ceathreamhnan (above Glenaffric).

107 & 108, Sutherland East and West : watershed between east and north-west Scotland, from Caithness border at Knockfin Heights over Meall a'Bhealaich, Ben Griam Beg, Ceann Garbh, Beinn Rosail, Cnoc na Gaoithe, Creag na h-Iolaire, Carn an Fheidh, The Crask, Bad a'Bhacaidh, Carn Dearg and Beinn Leoid to Ross and Cromarty border below Conival.

110, Outer Hebrides : Western Isles beyond the North Minch and Little Minch, including Lewis, Harris, North Uist, Benbecula, South Uist, Barra, St. Kilda, etc.

IRELAND.

119E & 119W, Donegal East and West : divided by Lough Swilly and western boundaries of baronies of Raphoe and Turhugh to City of Donegal ; part of Londonderry west of River Foyle is in 119E.

137 & 138, Mayo East and West : Lough Mask ; River Ayle to the Castlebar-Tuam road ; along this road to Castlebar ; River Clydagh (Cladagh) to Lough Cullin ; River Moy to the sea.

319, Galway West : part of Galway west of Lough Corrib (includes Connemara).

140N & 140S, Galway North-east and South-east : railway between Oranmore and Ballinasloe.

141, Clare : includes Aran Isles.

143 & 144, Tipperary North and South : Maryborough (Portlaoighise) to Charleville (Rath Luire) railway.

146E & 156M, Cork East and Mid : Charleville to Cork railway ; west shore of Cork Harbour to the sea.

146M & 147, Cork Mid and West (or South) : Killarney railway from Kerry border to Millstreet ; thence straight lines to Macroom and Bandon ; Bandon River to Kinsale Harbour.

148N & 148S, Kerry North and South : divided by western boundaries of baronies of Magunihy and Trughanacmy ; Dingle peninsula (Corkaguiny) is in 148S.

TABLE OF GEOLOGICAL STRATA.

HOLOCENE				
PLEISTOCENE	Upper Pleistocene :	Crayford, Brundon, Barnwell Abbey, Grantchester, Stutton, Admiralty, Brentford, Ightham, Merlin's Cave, Langwith Cave, Clevedon Cave, Banwell Cave, Ponders End, Angel Road, etc.		
	Middle Pleistocene :	Swanscombe, Grays Thurrock, Clacton, Ilford.		
	Lower Pleistocene	Cromerian : West Runton, Cromer, Bacton, Sidestrand, Little Oakley		
		Icenian [= Sicilian]	Weybourne Crag Chillesford Beds Norwich Crag	
PLIOCENE	Upper Pliocene	Red Crag	Butleyan [= Calabrian]	
			Newbournian Waltonian	[= Astian]
		Coralline Crag	Boytonian Gedgravian	
	Middle Pliocene :	Plaisancian (including Levantian)		
	Lower Pliocene :	Pontian		

SYSTEMATIC CONSPECTUS.

Explanatory Notes.

Numerals after the name of each species indicate the total number of counties and vice-counties for which the species has been satisfactorily authenticated ; numerals in italics indicate records which have not been confirmed by the Society's Recorder or referees, or occurrences regarded as due to introduction by human agency. For example, "**V. fasciatus** (Müller). 28 + *6*." means that there are authenticated records for 28 counties or vice-counties, and 6 reported occurrences which have not been verified from actual specimens, or are due to artificial introduction beyond the natural range of the species. The majority of the unconfirmed records are based on creditable evidence which there is no reason to question.

Ecological Data.—The brief notes on habitats are mainly derived from Boycott (1934, 1936), whose papers should be consulted for more detailed information.

Status. Unless otherwise stated, the species are regarded as native in the British Isles. Species presumed to be native may have been dispersed by human agency in some parts of their range, especially those living in gardens and artificial bodies of water ; in such cases the natural distribution cannot now be determined with any precision. Several species are known to have greatly extended their range within historical times (see Kennard, 1923) and the process continues. Species believed to have been introduced in recent times, but now established under natural conditions, are marked with an asterisk.

Littoral species, inhabiting the sea-shore, salt marshes and estuaries, more or less marine but closely related to freshwater groups, are marked with a double obelus.

Extinct species. Species extinct in the British Isles, but recorded from Holocene deposits, are marked with an obelus.

Geological Distribution. Only the earliest strata in which each species occurs fossil in the British Isles are given, except in special cases. Foreign fossil occurrences are usually mentioned only when they antedate British. In accordance with recent geological opinion, the Pleistocene period dates back to the Butleyan Red Crag.

Class **GASTROPODA.**

Subclass *PROSOBRANCHIA*

Order ARCHAEOGASTROPODA.

Family **Neritidae.**

THEODOXUS Montfort.

T. fluviatilis (L.). 72 + *4*. Hard water[1]; rivers and streams, usually swiftly flowing, also canals and river lakes. England, Somerset to Westmorland (Durham unconfirmed); Glamorgan; Orkney; Ireland. Europe: Baltic to Mediterranean, east to Russia. Holocene; Astian of N. Italy.

Order MESOGASTROPODA.

Family **Viviparidae.**

VIVIPARUS Montfort.

V. viviparus (L.). 44 + *8*. Hard water; slow rivers, canals, sometimes in reservoirs. England and Wales north to Yorkshire (Durham unconfirmed), rare or absent in extreme S. and W.; Edinburgh (dead shell); record for Limerick too doubtful to admit. Europe: France and Scandinavia to Urals. M. Pleistocene (*V. diluvianus* (Kunth), *V. clactonensis* Wood).

V. fasciatus (Müller). [This and the last species have been confused by some authors; see *Proc. Malac. Soc.* **14**, 88.] 28 + *6*. Hard water; rivers, canals, large drainage ditches. England, north to Yorkshire, absent from S.E., S.W. and W. midland counties; Heighington, Durham; Scales Tarn, Westmorland, introduced. Europe: S.E. Sweden and S. Finland to Iberian peninsula, Balkans and Russia; Siberia; alien in N. America. U. Pleistocene.

Family **Valvatidae.**

VALVATA Müller.

VALVATA *s.s.*

V. cristata Müller. 115 + *3*. Slow streams, lakes, ditches, etc. Generally distributed from Devon to Forfar, and in Ross and Orkney; throughout Ireland. Europe: Sweden to N. Spain, Macedonia and Russia; Siberia. Norwich Crag; Astian of N. Italy.

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[1] Boycott (1936, 149) defines "hard water" from the standpoint of Mollusca as water with not less than 20 mg. calcium per litre.

CINCINNA (Hübner) Mörch.

V. macrostoma Mörch [*V. pulchella* Studer (*nom. nud.*)]. 7 + *1*. Marsh drains, very local; S. and E. England. Central and N. Europe; Siberia; ? = *V. mergella* Westerlund, Alaska. Cromerian.

V. piscinalis (Müller). 135 + *1*. Rivers, streams, canals, marsh drains, lakes, usually in running water. Generally distributed, sparsely in N. Scotland. Europe, Siberia, Asia Minor; alien in Canada. M. Pleistocene; Kennard and Woodward (1926, 29) state that records from older strata are incorrect, fossils from Norwich Crag being *V. andreana* Menzel and possibly *V. piscinaloides* Michaud (see Kennard, 1944, 147); Ehrmann (1933, 205, 206) regards *V. andreana* and *V. antiqua* Morris (M. Pleistocene) as forms of *V. piscinalis*.

Family **Pomatiidae.**

POMATIAS Studer [*Cyclostoma* Draparnaud].

P. elegans (Müller). 46 + *4*. Scrub, woods, hedges, sandhills, etc., always on highly calcareous soil. England and Wales, mostly S. and E. S. and W. Europe north to Denmark; N. Africa; Syria, Asia Minor. U. Pleistocene; Astian of N. Italy.

Family **Acmidae.**

ACME Hartmann [*Acicula* Hartmann (*non* Renier)].

A. fusca (Montagu) [*A. lineata* of British authors, *non* Draparnaud; see Watson (1943, 14)]. 75 + 7. Old woodland and wild places; local in Great Britain, more frequent in Ireland. W. Europe, France to Westphalia. U.Pleistocene.

Family **Hydrobiidae.**

HYDROBIA Hartmann [*Paludestrina* Orbigny].

HYDROBIA *s.s.*

‡**H. ventrosa** (Montagu). 28 + *4*. Brackish water, salt marshes, estuaries. S. and E. coast of England; Bristol Channel; Anglesey; Outer Hebrides; a few widely separated localities in Ireland. W.Europe, Baltic, Gulf of Finland. Waltonian Crag (?), U. Pleistocene.

PERINGIA Paladilhe [*Sabinea* Sowerby (*non* Owen)].

‡**H. ulvae** (Pennant) [*H. stagnalis* (Küster)]. 82. Salt marshes, estuaries; widely distributed. N.W. Europe. Waltonian Crag.

PSEUDAMNICOLA Paulucci.

‡**P. confusa** (Frauenfeld). 11 + *1*. Brackish and nearly fresh water, marshes and river banks near sea. E. and S.E. England; Ireland, estuaries of Shannon, Suir, Barrow and Nore. S.W. Europe, Mediterranean. M. Pleistocene.

POTAMOPYRGUS Stimpson.

P. jenkinsi (Smith). 104 + *1*. Brackish and fresh water; estuaries, rivers, streams, canals, ditches, sometimes in lakes, reservoirs and ponds. Within the last 50 years has become widely distributed north to Orkney, though not yet recorded from considerable areas in Scotland and central

Ireland. Belgium to Poland; Baltic, Gulf of Finland; recently discovered near Barcelona and by Black Sea, Rumania. Holocene (Roman); see *Proc. Malac. Soc.* **24**, 156, and *Arch. Moll.* **80**, 57.

BYTHINELLA Moquin-Tandon.

***B. scholtzi** (A. Schmidt) [*Hydrobia steini* Martens; *Paludestrina taylori* Smith]. 3. Canals near Manchester and timber dock at Grangemouth, Stirling (*J. Conchol.* **20**, 55). Introduced, though present in Cromerian, U. Pleistocene and Holocene. Central and N. Europe, Holland to Finland and S.W. Russia.

BITHYNIA Leach [*Bulimus* Scopoli; application has been made to the International Commission on Zoological Nomenclature to reject this name].

B. tentaculata (L.). 114. Hard water; rivers, streams, canals, marsh drains, lakes, rarely in ponds. Great Britain (except W. Wales) north to Stirling; throughout Ireland. Europe; N.W. Africa; W. Siberia; alien in N. America. Norwich Crag; Plaisancian of France.

B. leachi (Sheppard). 55 + *5*. Hard water; rivers, canals, marsh drains. England (except S.W.) north to Yorkshire (Durham unconfirmed); local in Wales; Stirling (introduced); Ireland, Tipperary, S.E. Galway and Leinster. Palaearctic. Holocene; Pleistocene fossils are referred by Kennard (1944, 146) to *B. inflata* (Hansén), still living in central and N. Europe and Siberia.

Family **Assimineidae.**

ASSIMINEA Fleming.

‡**A. grayana** Fleming. 9. Brackish water, salt marshes, estuaries, banks of tidal rivers. E. coast of England from Kent to Humber. Belgium, Holland, Denmark. Holocene.

Subclass *PULMONATA.*

Order BASOMMATOPHORA.

Family **Ellobiidae.**

CARYCHIUM Müller.

C. minimum Müller (aggregate). 152. Generally distributed. There are as yet few records for the two segregates.

C. minimum *s.s.* Marshes and damp places. Europe. Cromerian.

C. tridentatum (Risso). Usually in drier habitats than *C. minimum*; woods, scrub, etc. Europe, N.W. Africa. M. Pleistocene.

LEUCOPHYTIA Winckworth [*Leuconia* Gray (*non* Grant)].

‡**L. bidentata** (Montagu). 26 + *4*. Coasts of E. and S.W. England; S. Wales; Isle of Man; Northumberland (dead shell); Clyde Isles (Brown, *Mollusca of the Firth of Clyde*, 1878, 110); parts of E., W. and S. coast of Ireland. W. and S. Europe, Atlantic Isles. U. Pliocene.

PHYTIA Gray.

‡**P. myosotis** (Draparnaud). 57 + *3*. Estuaries, salt marshes, mud flats. England and Wales north to Humber and Lancashire; Isle of Man; Durham and Northumberland (unconfirmed); Firths of Forth, Solway and Moray, Isle of Mull; all Irish coast. W. Europe north to Denmark,

Mediterranean; Atlantic Isles, S. Africa (*Ann. S. Afr. Mus.* **33,** 462); alien in N. America and Jamaica. Waltonian Crag. Var. *denticulata* (Montagu) is considered by some authors to be specifically distinct (see Watson, 1943, 21).

Family **Lymnaeidae.**

LYMNAEA Lamarck.

GALBA Schrank.

L. truncatula (Müller). 154. Marshes, swamps, river banks, ditches, wet meadows, shallow pools; generally distributed. Holarctic; S. Africa. Cromerian. *L. truncatuliformis* Schütze, Oligocene (Sannosian) of Bavaria, is said to be conspecific.

LEPTOLIMNEA Swainson [*Omphiscola* Beck (*non* Rafinesque)].

L. glabra (Müller). 39 + *10*. Ditches, ponds, marshes, splashes. Local in Great Britain north to Perth, not uncommon in N. England; Ireland, Wexford and unconfirmed record for Cork. W. Europe, S. Scandinavia to France. M. Pleistocene.

STAGNICOLA Jeffreys.

L. palustris (Müller). 139. Still water, ditches, marshes, etc. Generally distributed, except N.W. Scotland. Holarctic (not Iceland and Faroes); *L. vahlii* Möller, Greenland, closely related. Cromerian; Pontian of Hungary.

***L. catascopium** Say. Leith (*J. Conchol.* **21,** 279, 303; *Proc. Roy. Soc. Edin.* B, **61,** 430). N. America.

LYMNAEA *s.s.*

L. stagnalis (L.). 98 + *4*. Hard water; ponds, canals, slow rivers, marsh drains. England (not S.W.); Wales, mostly eastern; few places in Scottish Lowlands; Ireland (except S.W.). Holarctic (not Iceland and Greenland); alien in New Zealand and Tasmania. Cromerian; Plaisancian of N. Italy.

RADIX Montfort.

L. auricularia (L.). 104 + *2*. Hard water; slow rivers, canals, lakes, large ponds. Great Britain, Devon (Exeter canal) to Elgin; introduced in Cornwall; Ireland. Palaearctic (not Iceland); alien in N. America. Holocene (typical form); Kennard refers M. Pleistocene fossils from Swanscombe to var. *monnardi* Hartmann. Var. *acuta* Jeffreys is the prevailing form in Scotland and W. Ireland, and is recorded from several localities in England; Norwich Crag.

L. peregra (Müller) [including *L. ovata* Draparnaud]. 154. Ubiquitous. Palaearctic; Newfoundland; alien in Tasmania. Butleyan Crag; Plaisancian of France. *L. burnetti* Alder, Loch Skene, Dumfries, and *L. involuta* Thompson, mountain lakes in Sutherland, Cork and Kerry, are now regarded as subspecies; see *Proc. Malac. Soc.* **20,** 105; **23,** 101.

MYXAS Sowerby [*Amphipeplea* Nilsson].

L. glutinosa (Müller). 30 + *10*. Hard water; shallow lakes, ditches, rivers, canals. England, rare and local; central and N. Ireland. Europe, Sweden and Finland to Pyrenees and Russia; W. Siberia, Syria. U. Pleistocene.

Family **Physidae.**

APLEXA Fleming.

A. hypnorum (L.). 105 + *3*. Ponds, ditches, local and sporadic. Widely distributed, but absent from much of Wales and most of S., W. and N. Scotland; northern limit, North Uist. Holarctic (not Iceland and Greenland), to 73° 30′ N. in Taimyr Peninsula. M. Pleistocene. *A. subhypnorum* Gottschick, U. Miocene (Samartian) of Württemberg, is closely related.

PHYSA Draparnaud.

P. fontinalis (L.). 130 + *1*. Rivers, streams, marsh drains, sometimes lakes, usually in flowing water. Great Britain (not Cornwall) north to Aberdeen; general in Ireland. Europe (not Iceland); N. and central Asia to Amur; Canada (Hudson Bay). Cromerian; Plaisancian of Italy.

Physa *spp.* 26 + *1*. Much uncertainty prevails about the determination of alien *Physa*, usually recorded as *P. acuta* Draparnaud (Europe and central Asia) or *P. heterostropha* Say (N. America), which occur in rivers, canals, ditches, reservoirs, lily pools, tanks in botanic and nursery gardens, etc. in various parts of the British Isles. Stelfox (1911, 134) expresses the opinion that "in a group like that of the Physae it is practically impossible to give an imported species a name, unless one has some idea as to the origin of the specimens". Goodrich & Van der Schalie thus summarize the problem of N. American *Physa*: "No general rules have been laid down as yet that are helpful toward a certain and confident determination of the species of *Physa*." *Physa* from Glasnevin, Dublin, have been tentatively assigned to *P. gabbi* Tryon, *P. phillipi* Küster and *P. gyrina* Say, while the last has been recorded from Glamorgan. Undetermined alien *Physa* are recorded from Belfast and Castlewellan, Co. Down; see also *Irish Naturalists' Journal* **3,** 91.

Family **Planorbidae.**

PLANORBARIUS Froriep [*Coretus* Gray].

P. corneus (L.). 59 + *5*. Hard water; slow rivers, canals, ponds, marsh drains, lowland lakes. England and Wales, except most of the west coastal counties; introduced in Scotland; very local in Ireland. Europe, north to Sweden and Finland; Siberia, central Asia; alien in New Jersey, Porto Rico and Cuba. Norwich Crag; Pontian of Samos.

MENETUS H. & A. Adams.

MICROMENETUS Baker.

M. dilatatus (Gould). 4. Canals near Manchester; Loch a Mhuilinn, Raasay; regarded as alien in England, but in the Scottish locality "it has every appearance of being a native" (*J. Conchol.* **20,** 313). Eastern N. America. Pliocene of U.S.A.

PLANORBIS Müller.

PLANORBIS *s.s*

P. carinatus Müller. 92 + *2*. Hard water; slow rivers, canals, lakes, ponds, marsh drains. England and Wales (except extreme west); a few scattered localities in Lowlands of Scotland; Ireland, chiefly N., E. and central. Europe, Sweden and Finland to Portugal and Russia. Cromerian; Plaisancian of France.

P. planorbis (L.) [*P. umbilicatus* Müller; *P. complanatus* Jeffreys]. 103 + *3*. Hard water; rivers, canals, lakes, ponds, ditches, swamps; more frequently in smaller bodies of water than *P. carinatus*; distribution much the same, but more frequent in Scottish Lowlands; in Ireland "in the southern counties it is much commoner, while in the north-east the reverse is the case" (Stelfox, 1911, 115). Europe (not Iceland); N.W. Africa; Siberia, central Asia. Cromerian; M. Pliocene of France, Italy, Hungary and Rhodes.

ANISUS Studer.

P. vorticulus Troschel. 3 + *1*. Marsh drains. Sussex, E. Norfolk. Europe, Holland and Denmark to Bulgaria and S. Russia. Cromerian.

P. vortex (L.). 77 + *9*. Hard water; rivers, canals, lakes, ponds, ditches, usually in flowing water. Generally distributed in England; eastern part of Wales; a few widely scattered localities in Scotland north to Caithness; Ireland, mostly in Shannon basin. Europe, Pyrenees to Scandinavia, Finland (65° N.), Rumania and Russia; W. Siberia; closely related *P. paravortex* Ping & Yen in N.W. China. Cromerian; U. Pliocene of Holland.

P. leucostoma Millet [often called *P. spirorbis* (L.), but there is some uncertainty about the identity of this species]. 138 + *4*. Ponds, ditches, swamps, less commonly in rivers, canals and lakes. Generally distributed, sparsely in N. Scotland. Europe, W. Siberia. Butleyan Crag; M. Pliocene of N. Italy.

GYRAULUS Charpentier.

P. laevis Alder [*P. glaber* Forbes & Hanley; ? = *P. parvus* Say]. 74 + *12*. "Mostly north-western and living characteristically in shallow low-lying 'mountain' lakes, generally near the sea. . . . In such places it is common on the west coast of Ireland and has been found in a good many places in Scotland and the north of England. Of many of the southern records I am more doubtful" (Boycott, 1936, 145). Holarctic. Cromerian; Plaisancian of France. According to Kennard, *P. lateralis* Strickland and "*P. arcticus*" from Pleistocene are *P. laevis*.

P. albus Müller. 139. Still and running waters generally. Extends north to Sutherland, but absent from most of N.W. Scotland. Holarctic (not Iceland and Greenland). Cromerian; Plaisancian of Italy.

P. acronicus Férussac. 3. R. Thames and tributaries. N. Europe south to Switzerland. Cromerian and Holocene.

P. crista (L.) [*P. nautileus* (L.)]. 138 + *2*. Widespread in still and running water. Holarctic (to 66° N.). Cromerian; Plaisancian of Rhodes. [The record of *P. riparius* Westerlund from Ireland (*Irish Nat.* **1**, 192, **2**, 149) was an error for *P. crista*.]

BATHYOMPHALUS Charpentier.

P. contortus (L.). 137 + *2*. Usually in rivers, also ponds, marsh drains, swamps, etc. Generally distributed (except Cornwall and S.W.

Wales). Europe (not Iceland); Siberia north to 68° N., east to R. Amur. Cromerian.

SEGMENTINA Fleming.

HIPPEUTIS Charpentier.

S. complanata (L.) [*Planorbis fontanus* (Lightfoot); *P. nitidus* Jeffreys]. 114 + *2*. Hard water; ponds, ditches, etc. Great Britain from Devon to Ross, absent from most of W. and N. Scotland; general in Ireland. Palaearctic region (not Iceland), to 63° N. Cromerian; Pontian of France.

SEGMENTINA *s.s.*

S. nitida (Müller) [*S. lineata* Fleming]. 29 + *10*. Marsh drains, ponds; mainly S. and E. England, Sussex and Hampshire to Yorkshire and Lancashire (Durham and Cumberland unconfirmed); Wales, Glamorgan and Montgomery; museum record for Elgin. Europe (not Iceland) to 61° N.; W. Siberia, central Asia to Altai Mts. Cromerian; Pliocene of Asia Minor.

Family **Ancylidae.**

ACROLOXUS Beck.

A. lacustris (L.). 102 + *2*. Hard water; ponds, lakes, canals, slow rivers. Great Britain north to Aberdeen, rare or absent in S.W. England, much of Wales, W. and N. Scotland; Ireland, mainly N.E. and central. Europe, S. Scandinavia and Finland to Catalonia, Tuscany, Croatia and Russia; Siberia to R. Amur, central Asia. Cromerian; Astian of Ukraine.

ANCYLUS Müller.

A. fluviatilis Müller. 147 + *3*. Usually in running water, sometimes lakes and tarns; generally distributed. Europe (not Iceland); N.W. Africa. Cromerian; Astian of N. Italy.

Order STYLOMMATOPHORA.

Family **Succineidae.**

CATINELLA Pease.

QUICKELLA Boettger.

C. arenaria (Bouchard-Chantereaux). 5. Marshes, wet hollows in sand-dunes, very rare. Braunton Burrows, N. Devon; Ireland. W. Europe, France to Scandinavia and Baltic islands. Cromerian. See Quick (1933, 309, pl. 25).

SUCCINEA Draparnaud.

SUCCINELLA Mabille [*Hydrophyga* Lindholm].

S. oblonga Draparnaud. ? 25. Marshes, sides of ditches. Rare in Great Britain, more frequent in Ireland; most records are from maritime counties; some of those unconfirmed since 1933 may be referable to *C. arenaria.* Europe (not Iceland) north to Scandinavia, east to Transcaucasia, very local in south. M. Pleistocene; the Pleistocene form is var. *agonostoma* Küster; Plaisancian of France.

SUCCINEA *s.s.*

S. putris (L.). 115 + *29*. Marshes, banks of rivers, lakes, etc.; less hygrophilous than the two following species. Generally distributed in southern part of Great Britain and in Ireland; records for Scotland require verification, as since the determination of the species of *Succinea* was placed on a sound basis by Quick (1933), *S. putris* has been authenticated from only Dumfries, Kirkcudbright and Selkirk. Europe (not Iceland nor Mediterranean peninsulae); Siberia east to R. Amur. Butleyan Crag.

OXYLOMA Westerlund.

S. pfeifferi Rossmässler [*S. elegans* of most British authors before 1926]. 151. Marshes, banks of rivers, canals, streams, etc.; generally distributed. Europe; N.W. Africa; Syria, Armenia; *S. groenlandica* Möller, Iceland, Greenland and Newfoundland, is closely related or conspecific. Butleyan Crag; Astian of Italy.

S. elegans Risso [Odhner (1949, *Vidensk. Medd. fra. Dansk naturh. Foren.* **3**, 217) suggests that this is not identical with *S. elegans* Risso, but should be known as *S. sarsi* Esmark]. 2 + 7. Swamps, marshes, river banks, usually in wetter places than the last two species, often on floating leaves of aquatic plants. Confirmed by dissection from E. Norfolk and Herts; records based on shells for S.E. England and Somerset. N. Europe; ? Siberia. M. Pleistocene; Astian of Holland.

Family **Cochlicopidae.**

AZECA Fleming.

A. goodalli (Férussac) [*A. tridens* (Pulteney); *A. menkeana* (C. Pfeiffer)]. 55 + *3*. Woods and hedges, local. England and Wales (rare in S.W.); Perthshire. W. Europe, Pyrenees to Holstein. M. Pleistocene.

COCHLICOPA Férussac [*Cionella* Jeffreys; *Zua* Turton].

C. lubrica (Müller). 155. Almost ubiquitous. Holarctic (to 70° N.); alien in New Zealand. Butleyan Crag.

C. minima (Siemaschko) [*C. exigua* (Menke), *C. lubricella* (Stabile), *Cionella pulchella* (Hartmann) Mousson]. Mandahl-Barth (*Flora og Fauna* **56**, 85–90) has recently adduced evidence for the specific distinctness of this form, formerly regarded as a variety of *C. lubrica*. It is widely distributed in the British Isles, though so far authenticated only for vice-counties 17, 29, 33, 82, 88, 146M, 147. (See Pilsbry, *Manual of Conchology* **19**, 321, pl. 49, figs. 36–38, 41).

Family **Vertiginidae** [Pupillidae].

PYRAMIDULA Fitzinger.

P. rupestris (Draparnaud). 90 + *13*. Rocks, cliffs, stone walls, especially on limestone. Generally distributed in England, Wales and Ireland, but no confirmed records for eastern counties from Essex to The Wash; local in central Scotland; rare in N. Ireland. Central, W. and S. Europe; N.W. Africa; Syria, Persia. U. Pleistocene.

COLUMELLA Westerlund [*Sphyradium* Charpentier (*pars*)].

C. edentula (Draparnaud). 139 + *4*. Woodland, marshes, wild and cultivated places generally. Holarctic (not Greenland), to 70° N. Norwich Crag (Reeve). *C. columella* (Benz) is a form or subspecies occurring in Pleistocene and living in mountainous districts (Pyrenees, Alps, Carpathians) and extreme north of Europe.

TRUNCATELLINA Lowe.

T. cylindrica (Férussac) [*Pupa minutissima* Hartmann]. ? 15 + *4*. Dry exposed places, hillsides, sandhills, maritime turf, rare and local. E. England and E. Scotland ; Ireland, records for Antrim and Down require confirmation, that for Kerry very dubious. Europe north to S. Scandinavia ; N.W. Africa ; Asia Minor. M. Pleistocene.

T. cylindrica britannica Pilsbry. 3. Dry calcareous places. Devon (Branscombe), Dorset coast, Isle of Wight. Schlesch considers that *T. strobeli hooveni* Bayer, Holland, is conspecific. Originally described as a subspecies of *T. rivierana* (Benson), but regarded by Watson (1943, 31–38) as a subspecies of *T. cylindrica*, and by Kennard & Woodward (1926, 128) as a distinct species ; seems to be close to *T. monodon* (Held).

VERTIGO Müller.

VERTIGO *s.s.*

V. pusilla Müller. 37 + *6*. Amongst moss, on walls amongst ivy, dead leaves, etc., rare. E., central and N. England, not south of Berkshire (except N. Devon) ; N. Wales ; S.W. Scotland and a few localities north to Elgin ; Ireland, recorded actually living in 4 counties. Europe, from 60° N. to Pyrenees, Sicily, Balkans and Transcaucasia. M. Pleistocene ; Plaisancian of France.

V. antivertigo (Draparnaud). 114 + *7*. Marshes, river banks, etc. Widely distributed north to Sutherland. Europe, Scandinavia and Finland to Pyrenees and Transcaucasia ; Turkistan ; N.W. Africa ; subfossil in Egypt and Bechuanaland (*Ann. S. Afr. Mus.* **33,** 403) ; *V. ovata* Say, N. America, seems closely related. Cromerian. *V. pseudoantivertigo* Paladilhe, Plaisancian of France, is closely related.

V. substriata (Jeffreys). 102 + *6*. Woods and moist places. Great Britain, Devon to Sutherland, not common in England south of Stafford ; generally distributed in Ireland. Europe, generally boreal-alpine, from 67° N. in Norway to Caucasus and possibly Armenia ; *V. milium* (Gould), N. America, is closely related. U. Pleistocene.

V. pygmaea (Draparnaud). 143 + *3*. Meadows, marshes, woods, wild and cultivated places generally. Europe, from 63° 30′ N. in Norway east to Urals and Transcaucasia (not S. Iberian nor Balkan peninsulae) ; N. America. M. Pleistocene ; Astian of Italy.

V. genesii Gredler. 4. Margins of peat bogs in Ireland, at intervals along a line running N.W. across the central limestone plain from Mountmellick and Roscrea to Tuam (*J. Conchol.* **17,** 236, **20,** 142). Denmark, Sweden, Baltic States, Germany, Austria, Poland, Russia ; Siberia east to Amur. U. Pleistocene ; see Kennard (1937, 378).

†**V. parcedentata** (Braun) [*V. concinna* Scott]. U. Pleistocene, Holocene. Living in Switzerland ; Pleistocene of Holland, Bavaria and Austria.

V. moulinsiana (Dupuy). 23 + *3*. Fens and marshes, rare and local, though common in Norfolk Broads district. E. and S. England; Ireland, Clare, Tipperary and Leinster. Europe, Denmark and Lithuania to Pyrenees, Sicily, Bulgaria and Transcaucasia; *V. elatior* Sterki, N. America, seems closely related. M. Pleistocene.

V. lilljeborgi Westerlund. 25. Lake margins. English Lake District; Scotland; W. Ireland; see *J. Conchol.* **18,** 313, **19,** 296. Scandinavia (to about 68° N.), W. Jutland, Finland, Russia, E. Pyrenees. U. Pleistocene, Barrington, Cambridge; Holocene, Boveney, Bucks, and Scawby, Lincoln.

V. alpestris Alder. 8. Rocks, stone walls. N. England (see *J. Conchol.* **12,** 209, 309, pl. 4); N. Wales (Dolgelly); Isle of Mull. Europe, mostly northern and alpine; Siberia; Newfoundland; Canada (subsp. *oughtoni* Pilsbry). U. Pleistocene.

VERTILLA Moquin-Tandon.

V. angustior Jeffreys. 16 + *9*. Marshes; more often found among flood debris than alive. Very rare and local in England and Wales; Sutherland; more frequent in Ireland, especially in west. Europe, from about 63° N. in Sweden to Portugal and Talish district on Caspian (not S. Spain, S. Italy, Balkans). U. Pleistocene; Plaisancian of France.

PUPILLA Fleming.

P. muscorum (L.) [*Pupa marginata* Draparnaud]. 107 + *4*. Short turf, loose stones, old walls, sandhills, etc., not in woods. Generally distributed, sparsely in Scotland. Holarctic (to 70° N.). Butleyan Crag; Pontian of Hungary. *P. submuscorum* Gottschick & Wenz, Sarmatian of Württemberg, is closely related. [" *P. triplicata* (Studer)" recorded from Suffolk was a form of *P. muscorum* (*J. Conchol.* **11,** 319, **15,** 165)].

LAURIA Gray.

LAURIA *s.s.*

L. cylindracea (da Costa) [*Pupa umbilicata* Draparnaud]. 155. Woods, walls, rocks, cliffs, hedges, etc., generally common. Europe, chiefly coastal regions and islands, from Faroes and Norway (63° N.) south through Denmark and W. Germany to Mediterranean, east to Armenia; Madeira, N. Africa; alien in S. Africa (*Ann. S. Afr. Mus.* **33,** 400). Norwich Crag.

LEIOSTYLA Lowe.

L. anglica (Wood) [*Pupa ringens* Jeffreys]. 88 + *5*. Damp places, woods, marshes, cliffs. Generally distributed in northern half of Great Britain and in Ireland, rare in south. Portugal, Île du Ré, Algeria. U. Pleistocene.

ABIDA Turton.

A. secale (Draparnaud). 26 + *4*. Hillsides, rocks, dry woods, etc., on limestone, local. England north to Cumberland (not eastern counties except Lincoln). Europe, chiefly alpine, south to Portugal, Tuscany and Serbia, north to Westphalia. U. Pleistocene.

Family **Valloniidae.**

ACANTHINULA Beck.

ACANTHINULA *s.s.*

A. aculeata (Müller). 135 + *1*. Woods, hedges, amongst dead leaves, etc.; generally distributed. Europe, north to about 60° N. in Scandinavia and Finland, east to Transcaucasia; N.W. Africa. M. Pleistocene; Plaisancian of France.

SPERMODEA Westerlund.

A. lamellata (Jeffreys). 72 + *8*. Old woodland, local. Generally distributed in Great Britain north from Stafford and in Ireland (rare in central area); a few localities in S. England and Wales. Europe, Holland to Scandinavia (64° N.) and East Prussia. U. Pleistocene; Pleistocene of Bavaria and Saxony. *A. plicatella* (Reuss), U. Oligocene, Prussia, L. Miocene, Bohemia, is closely related.

VALLONIA Risso.

V. costata (Müller). 106 + *2*. Wild and cultivated ground, not in woods; normally in drier habitats than *V. pulchella*. Generally distributed in England, Wales and Ireland; E. Scotland north to Aberdeen, and Inner and Outer Hebrides. Holarctic (to 70° N.); alien in Australia and Tasmania. M. Pleistocene.

V. pulchella (Müller). Aggregate 146, segregate 95. Wild and cultivated ground, meadows, marshes, etc., not in woods; generally distributed. Holarctic; alien in S. Africa, Australia, Tasmania and Bermuda. Butleyan (?) and Norwich Crag.

V. excentrica Sterki. 103 + *1*. Characteristically in drier habitats than *V. pulchella*; distribution similar; not separated in Census records until 1904. Holarctic. Norwich Crag. [Some authors regard *V. excentrica* as a form of *V. pulchella*.]

Family **Enidae.**

ENA Turton.

E. montana (Draparnaud). 13 + *1*. Old woodland, chiefly beech, scrub, old hedges, on limestone, local and seldom numerous; see *J. Conchol.* **21,** 153. S. England, W. Sussex to Chilterns, Cotswolds and Mendips, and W. Suffolk; near Fermoy, Co. Cork. Central and W. Europe, becoming sporadic north of central Germany to S. Sweden and S. Estonia. M. Pleistocene.

E. obscura (Müller). 108. Woods, hedges, etc. Generally distributed north to Elgin, absent from N. and most of W. Scotland; infrequent in Ireland, absent from considerable areas in N., W. and S.W. Europe north to Scandinavia (60° N.) and Estonia, east to Transcaucasia; N.W. Africa. U. Pleistocene.

Family **Clausiliidae.**

MARPESSA Gray [*Cochlodina* Férussac].

M. laminata (Montagu). 65 + *4*. Woods, hedges, etc. Frequent in England, sparsely distributed in S. and N. Wales, E. Scotland and Ireland. Europe, Norway (64° N.) and Finland to Pyrenees and Caucasus. M. Pleistocene.

CLAUSILIA Draparnaud.

CLAUSILIA *s.s.*

C. bidentata (Ström) [*C. nigricans* (Maton & Rackett); *C. rugosa* (Draparnaud) is said to be a distinct species, not British (*J. Conchol.* **17,** 267; Watson, 1943, 39)]. 151 + *1*. Woods, hedges, cliffs, walls, rocks, wild and cultivated places generally. Europe, mainly W. and N., from Norway (70° N.) to Portugal. Cromerian.

C. dubia Draparnaud. 9 + *9*. Rocks and walls. N. England; Outer Hebrides; Dover (introduced); unconfirmed records for vice-counties 18, 20, 23, 25, 83, 85 (32 erroneous). Europe, Scandinavia (64° N.) to N. and E. France, Switzerland, Austria and Albania. U. Pleistocene; Plaisancian of Hungary. The form from N. England is subspecies *suttoni* Westerlund [*C. cravenensis* Taylor]. See *J. Conchol.* **18,** 251, 256, **21,** 289.

PLICAPHORA Hartmann [*Iphigena* Gray (*nom. nud.*); *Iphigenia* Gray (*non* Schumacher)].

C. rolphi Turton. 22 + *3*. Woodland, scrub, hedges, on calcareous soil. S. and central England north to Lincoln, local. Europe, W. Germany and E. Holland to Catalonia. Holocene.

LACINIARIA Hartmann.

L. biplicata (Montagu). 7 + *5*. Hedges, banks, river sides; very rare, though still fairly plentiful in a few localities near London and at Cambridge; doubtfully native in Herts; see *J. Conchol.* **18,** 340. Europe, S. Scandinavia to N. France, Tyrol and Thessaly. Holocene.

BALEA Gray.

B. perversa (L.). 141 + *3*. Rocks, walls, trees; generally distributed. Europe, Iceland, Scandinavia (68° N.) and Finland to Portugal, Italy and W. Mediterranean islands; Atlantic Isles (not S.E. Baltic states, Poland and Russia, except Crimea). U. Pleistocene.

Family **Ferussaciidae.**

CECILIOIDES Férussac.

C. acicula (Müller). 78 + *5*. Subterranean; meadows, downs, old quarries, cliffs, graves, etc., on calcareous soil. Generally distributed in England; S. Wales, also Denbigh and Anglesey; E., central and S. Ireland, rare. W. and central Europe north to Denmark and S. Sweden, east to Armenia; Atlantic Isles; alien in N. America, S. Africa, Hawaii, New Zealand. M. Pleistocene; Plaisancian of France. *C. aciculella* (Sandberger), U. Miocene of Württemberg and Galicia, is closely related.

Family **Testacellidae.**

TESTACELLA Draparnaud.

T. maugei Férussac [*T. haliotoides* Lamarck (*nom. nud.*)]. 32 + *1*. Gardens. England and Wales, probably native only in S.W.; S. Ireland. W. coast of Europe, Dieppe to Gibraltar; Morocco; Atlantic Isles; alien in N. America and S. Africa. Holocene.

T. haliotidea Draparnaud [*T. europaea* Roissy]. 49 + *2*. Gardens. Widely distributed in England; Radnor in Wales; S. Scotland; S.W.

Ireland, Tyrone and Dublin; perhaps native only in S. and S.W. of England and Ireland. S.W. Europe, Belgium to Spain, Italy and Dalmatia; Corsica, Balearic and Atlantic Isles; Algeria; alien in N. America. Plaisancian of France.

T. scutulum Sowerby. 51 + *2*. Gardens. Widely distributed in England; Glamorgan and Caernarvon in Wales; central Scotland; sparse in Ireland. France, Spain, Italy, W. Mediterranean islands; Algeria.

Family **Helicidae.**

FRUTICICOLA Held [*Eulota* Hartmann].

F. fruticum (Müller). 2. Hedges. Dover, Deal and Penshurst, Kent, probably introduced. Europe, Lapland (66° N.) to France, N. Italy, Macedonia and Caucasia; Siberia to Amur. Butleyan Crag; U. Pleistocene (not in English Holocene).

HELICODONTA Férussac [*Obvoluta* Scudder].

H. obvoluta (Müller). 3. Old woodland, mainly beech, old hedges, scrub. South Downs from near Winchester to Rackham, W. Sussex. Europe, Schleswig to Catalonia, S. Italy and S. Serbia. U. Pleistocene, Herts, Cambridge; Astian of N. Italy.

HELICIGONA Férussac [*Vortex* Oken (*pars*); *Chilotrema* Turton].

H. lapicida (L.). 55 + *2*. Woods, rocks, walls, mainly on limestone. England, Devon to Yorkshire (Durham unconfirmed), absent from N.W.; E. counties of Wales; formerly at Hawick, Roxburgh; Fermoy, Co. Cork. Europe, S. Scandinavia (64° N.) and S. Finland (not Estonia and Latvia) to Portugal, N. Spain, Piedmont, Austria and Carpathians. M. Pleistocene; Plaisancian of France.

ARIANTA Turton.

A. arbustorum (L.). 120 + *4*. Wild places, marshes, river banks, damp woods, mountains, etc. Generally distributed in Great Britain; very local in Ireland and absent from southern half (doubtful records for N. Kerry and Limerick). N. and central Europe, Iceland, Scandinavia (70° 25′ N.) and N. Finland to Catalonia, Switzerland, Austria, Carniola, Carpathians and possibly W. Russia; alien in Newfoundland. Butleyan Crag; Plaisancian of Hungary.

THEBA Risso [*Euparypha* Hartmann].

T. pisana (Müller). 7 + *5*. Sand-dunes, cliffs and waste places near sea, rare but locally abundant. Channel Islands, W. Cornwall (not recently reported), Dorset (Muston Down, probably introduced), Glamorgan, Pembroke, Louth, Meath and Dublin; other records probably casual introductions. Coastal regions of France, Iberian peninsula, entire Mediterranean region, Atlantic coast of Morocco, Atlantic Isles; introduced in Belgium, Switzerland, Somaliland, S. Africa, California and Australia. Holocene (Neolithic), Jersey; Astian of Algeria.

HELIX Linnaeus.

CEPAEA Held.

H. hortensis Müller. 132 + *3*. Wild and cultivated ground. Generally distributed in Great Britain; N., E. and central Ireland, local. Europe, Iceland, Scandinavia (67° N.) and S. Finland to N. Spain, Switzerland, Austria and Hungary; eastern N. America. Waltonian Crag.

H. nemoralis L. 143. Woods, hedges, marshes, downs, sand-dunes, cliffs, churchyards, etc. Generally distributed north to Skye, absent in N. and N.E. Scotland. Europe, Scandinavia (63° N.) and Finland to Iberian peninsula, Italy and Bosnia; in the northern part of its range only in gardens; alien in N. America. Butleyan Crag.

CORNU Born [*Cryptomphalus* Moquin-Tandon].

H. aspersa Müller. 149. Wild and cultivated places, frequent in gardens and widely dispersed by man. Extends north to Moray Firth and Outer Hebrides, also Orkney, but rare or absent in considerable areas. W. Europe, Holland to Iberian peninsula; entire Mediterranean region; Black Sea coasts; Atlantic Isles; introduced in many parts of the world. U. Pleistocene; Astian of Algeria.

HELIX *s.s.*

H. pomatia L. 14 + *5*. Open woodland, copses, scrub, hedges, downs, hillsides, quarries, etc., on limestone, local. S. England, north to Northampton and west to Gloucester. Europe, France, Belgium and Holland to N. Italy, Thessaly, Poland and Ukraine, spread by man to N. Germany, Baltic states, Denmark and S. Sweden; alien in Buenos Aires and Montevideo. Holocene; Plaisancian of Hungary.

HYGROMIA Risso.

HYGROMIA *s.s.*

***H. limbata** (Draparnaud) [*H. odeca* (Locard)]. 1 + *3*. Hedges and cliffs by Teign estuary and at Maidencombe, S. Devon, well established over considerable area; adventive near Hampstead and at Belfast and Belmont, Co. Down. France, N. Spain.

***H. cinctella** (Draparnaud). 1. Paignton and near Bishopsteignton, S. Devon (*J. Conchol.* **23**, 99, 135, 136). Europe, central and S. France, S. Alps, Mediterranean; spread in recent times into Switzerland, introduced in Hungary and Czechoslovakia.

ZENOBIELLA Gude & Woodward.

H. subrufescens (Miller) [*Helix fusca* Montagu (*non* Poiret)]. 105 + *13*. Woods, damp wild places, cliffs, etc.; see *J. Conchol.* **17**, 243. Great Britain, mainly W. and N., very rare or absent in S.E. and E. counties; Ireland, generally distributed, except in central area. Belgium, W. France.

TRICHIA Hartmann [*Trochulus* (Férussac) Kennard].

H. striolata (C. Pfeiffer) [*Helix rufescens* da Costa (*non* Pennant)]. 134 + *5*. Woods, hedges, gardens, etc. Generally distributed north to Aberdeen, widely dispersed by man. W. and central Europe; alien in N. America. U. Pleistocene.

H. hispida (L.). 142. Wild and cultivated places. Generally distributed north to Kincardine, also in Hebrides and Orkney. Europe, Scandinavia (66° N.) to Pyrenees, N. Italy, Sardinia, Serbia and central Russia; alien in N. America. Butleyan Crag.

H. liberta (Westerlund) [*Helix sericea* Draparnaud]. 18. Woods, hedges, etc. Mainly central England, authenticated by Kennard (no Census records). Central Europe, mainly alpine, Catalonia north to S.E. Belgium and Germany, east to Hungary and Macedonia. U. Pleistocene.

PONENTINA Hesse.

H. subvirescens (Bellamy) [*Helix revelata* Gray (*non* Férussac)]. 8 + *1*. Grassy slopes near sea. Channel Islands, S.W. England, Pembroke. W. France, Spain, Portugal, N.W. Africa. Holocene (recorded as *H. montivaga* (Westerlund), *Proc. Malac. Soc.* **5**, 186).

MONACHA Fitzinger.

ASHFORDIA Taylor.

M. granulata (Alder) [*Helix sericea* Jeffreys (*non* Müller)]. 91 + *13*. Mainly in damp or shady places, though occurs in drier habitats in W. and N. Widely distributed in England and Wales, more sparsely in Scotland north to Moray Firth and Outer Hebrides; rare in Ireland and mainly in S.W. Apparently endemic in British Isles. M. Pleistocene.

MONACHA *s.s.*

M. cartusiana (Müller). 5 + *9*. Downs and grassy banks on calcareous soil. Hampshire, Sussex, Kent, Suffolk; most of the other records are probably casual introductions. W. and S. Europe, north to Holland (introduced in Denmark and Mecklenburg), east to Caucasus; Asia Minor, Syria. Holocene; U. Pliocene of N. Italy (Astian) and Tuscany (Sicilian).

M. cantiana (Montagu). 50 + *4*. Waysides, borders of fields, banks, etc., mostly amongst tall grass and herbage, on calcareous soil. Generally distributed in England (except N.W.) from Devon to Durham; Cornwall (dead shell); Glamorgan; introduced in Fife, Dublin and E. Cork. W. Europe, Oldenburg to France; introduced at Rostock; records from Mediterranean region probably based on allied species; alien in Canada. Holocene (Roman period).

HELICELLA Férussac [*Jacosta* Gray].

CANDIDULA Kobelt.

H. caperata (Montagu) [? *Helix intersecta* Poiret]. 139 (?). Dry grassy places, downs, sand dunes, edges of cornfields, etc., on calcareous soil; generally distributed [some of the few records unconfirmed since 1912 may be based on *H. gigaxi*]. W. Europe, Portugal to Denmark and S. Sweden; alien in Madeira, N. America, Australia and Tasmania. U. Pleistocene.

H. gigaxi (L. Pfeiffer) [*H. heripensis* (Mabille)]. 48 + *6*. Dry grassy places, hedge-banks, roadsides, edges of cultivated fields, etc., on calcareous soil. Generally distributed in England (except S.W. peninsula and N.W.); N. Wales and Glamorgan; Berwick and Haddington in Scotland; probably introduced in Ireland. W. Europe, Catalonia to Holland and W. Germany. Holocene.

CERNUELLA Schlüter.

H. virgata (da Costa) [*H. variabilis* (Draparnaud)]. 104 + *5*. Dry grassy places, downs, sand-dunes, banks, sides of fields, etc., on calcareous soil. Generally distributed in England and Wales; sparse in Scotland north to Aberdeen and Inner Hebrides, probably introduced in vice-counties 82, 85, 87 and 93; in Ireland absent from a number of northern counties. W. Europe north to Holland; Mediterranean region; alien in Australia. M. Pleistocene. [Some Continental authors regard var. *maritima* Draparnaud as a distinct species.]

XEROCINCTA Monterosato.

***H. neglecta** (Draparnaud). 1. Luddesdown, near Rochester, W. Kent. France, Catalonia, Mediterranean region; introduced in Thuringia. Pontian of Algeria.

HELICELLA *s.s.*

H. itala (L.) [*H. ericetorum* (Müller)]. 113 + *4*. Dry grassy places, downs, sand-dunes, banks, etc., on calcareous soil. Generally distributed in England and Ireland; N. and S. coasts of Wales; S.E., W. and N. Scotland. Europe, N. Spain to Holland (introduced in Denmark), east to Bohemia and W. Poland; alien in Australia and New Zealand. M. Pleistocene. [Westerlund described the peculiar form from the Aran Islands as *Helix lampra* var. *scythropa*].

TROCHOIDEA Brown [*Trochula* Schlüter].

***H. elegans** (Gmelin) [*Helix terrestris* Donovan (*non* Pennant)]. 2 + *3*. Banks and hillsides on chalk. Near Dover, Kent, and Chaldon, Surrey; old records for Cornwall, Northampton and Cumberland (see *J. Conchol.* **23,** 167). Mediterranean region and across S. France to Bordeaux; introduced in N.W. France and Switzerland, and South Carolina.

COCHLICELLA Férussac [*Longaeva* Menke].

C. acuta (Müller) [? *Helix barbara* L.]. 67 + *5*. Dry grassy places, downs, banks, sand-dunes, on calcareous soil, mainly maritime in Great Britain. S. and W. coasts north to Caithness; introduced near Greenhithe, W. Kent; Holocene (Saxon period) at West Hythe, E. Kent; coasts of Ireland and extending inland in central area. S.W. Europe; Mediterranean region; Atlantic Isles; alien in Australia. U. Pleistocene; U. Pliocene of Algeria.

Family **Endodontidae.**

PUNCTUM Morse.

P. pygmaeum (Draparnaud). 147 + *1*. Woods, hedges, marshes, among dead leaves, etc.; generally distributed. Palaearctic region (to 70° N.); closely allied species in N. America. Cromerian; Astian of Holland.

DISCUS Fitzinger [*Gonyodiscus* Fitzinger].

†D. ruderatus (Férussac). Cromerian to Holocene. Living in Europe, north to Finmark, south to E. Spain, N. Italy and Transcaucasia; N. Asia to Kamchatka and Japan; *D. cronkhitei* (Newcomb), N. America, is closely related.

D. rotundatus (Müller). 155. Almost ubiquitous. Europe, north to 63° N. in Norway, east to Crimea; Algeria; Atlantic Isles; alien in N. America. M. Pleistocene.

Family **Arionidae.**

GEOMALACUS Allman.

G. maculosus Allman. 2. Rocks and woods. Ireland, Kerry and W. Cork. Brittany, N.W. Spain, Portugal.

ARION Férussac.

A. intermedius Normand [*A. minimus* Simroth]. 150 + *1*. Woods, fields, marshes, etc.; generally distributed. Europe, Iceland, Faroes, Scandinavia (65° N.) and Finland to Portugal and N. Italy; Azores; alien in N. America, S. Africa and New Zealand.

A. circumscriptus Johnston. 153. Woods, fields, gardens, etc.; generally distributed. Europe, Iceland (? introduced), Faroes and Scandinavia (69° N.) to France (? Spain), N. Italy, Rumania and W. Russia; alien in N. America.

A. hortensis Férussac. 154. Wild and cultivated places generally, common in gardens. Europe, Iceland (? introduced), Faroes, Scandinavia (63° N.) and Lithuania to N. Spain, Italy, Carpathians and Serbia; alien in N. America, S. Africa, Australia, Tasmania and New Zealand.

A. subfuscus (Draparnaud). 148. Woodland and wild places, sometimes in gardens; generally distributed. Europe, Iceland, Faroes and Scandinavia (69° N.) to Catalonia, N. Italy, Serbia and Russia; alien in N. America and New Zealand.

A. lusitanicus Mabille. 1 + *1*. Recorded for W. Cork by Collinge (*Ann. Mag. Nat. Hist.* (6) **12,** 414) and recently confirmed by Dr. H. E. Quick for Durham (garden). S. W. Europe, Algeria, Atlantic Isles.

A. ater (L.). 155. Wild and cultivated places; generally distributed. N.W. Europe (to 70° N.); alien in N. America and New Zealand.

A. rufus (L.). 5. See *J. Conchol.* **22,** 249; hitherto authenticated only for Glamorgan and a few places in southern half of England. Central Europe; introduced in Denmark and Sweden.

Family **Zonitidae.**

EUCONULUS Reinhardt [*Petasina* Gude & Woodward (*non* Beck); placed by some authors in family Helixarionidae or Ariophantidae].

E. fulvus (Müller) [*Helix trochiformis* Montagu]. 154. Woods, marshes, etc.; generally distributed. Holarctic. Cromerian.

VITREA Fitzinger.

V. crystallina (Müller). 154. Marshes, woods, meadows, hedges, etc.; generally distributed. Europe north to Iceland and Scandinavia (66° N.), east to central Russia and Caucasus; Atlantic Isles; alien in S. Africa, New Zealand, Tasmania, etc. Cromerian.

V. contracta (Westerlund). Formerly regarded as a variety of *V. crystallina*, but recognized by Continental authors as a distinct species (*Basteria* **12,** 28). Figured by Taylor (**3,** 113), who gives a list of localities; Stelfox (1911, 77) considers it to be more widely distributed than *V. crystallina* in Ireland, and Kennard states that Pleistocene fossils are this form. Europe, Iceland, Faroes and S. Scandinavia to N. Spain, N. Italy and Bulgaria.

OXYCHILUS Fitzinger.

O. draparnaldi (Beck) [*Helix lucida* Draparnaud (*non* Pulteney)]. 86 + *6*. Wild places in S.W., elsewhere mostly in gardens. Distributed north to Aberdeen, also in Outer Hebrides, Orkney and Shetland; in Ireland mostly in southern half. S. and W. Europe; introduced in N. Germany, Denmark, and S. Scandinavia; greenhouses in Finland; N.W. Africa, Madeira; alien in N. America and S. Africa. Holocene.

O. cellarius (Müller). 155. Nearly ubiquitous. Central Europe and W. Mediterranean region; introduced in Scandinavia and S. Finland; records for S. Russia require confirmation; Algeria, Atlantic Isles; alien in N. America, S. Africa, Australia, Tasmania, New Zealand, etc. M. Pleistocene; Plaisancian of France. [*Vitrea hibernica* Kennard is a large Irish race of *O. cellarius.*]

O. alliarius (Miller). 154. Nearly ubiquitous. Europe, Iceland, Scandinavia (69° N.) and Estonia to France and Poland; alien in N. America, St. Helena, S. Africa, Juan Fernandez, Australia and New Zealand. U. Pleistocene.

O. helveticus (Blum) [*O. rogersi* (Woodward)]. 74 + *8*. Woods, copses, hedges, etc. Great Britain north to Banff, sparse in Scotland; Irish records erroneous and referable to *O. cellarius* var. *scharffi* (Kennard). France, Belgium, Switzerland; alien in California. Holocene.

RETINELLA Fischer.

PERPOLITA Baker.

†**R. petronella** (L. Pfeiffer). Holocene, Broughton, Lincolnshire (Kennard, 1937), Nazeing, Essex, Finn Valley, Suffolk. Living in mountainous regions of central Europe, extending north to Norway (71° N.) and Finland, east to Siberia and Manchuria. Pleistocene of Germany.

R. radiatula (Alder) [? *Helix hammonis* Ström]. 154. Nearly ubiquitous. Holarctic; Europe, Iceland, Faroes and Scandinavia (71° N.) to N.E. Spain, N. Italy and Russia; Siberia; sub-species *electrina* (Gould) and *binneyana* (Morse) in N. America. M. Pleistocene.

AEGOPINELLA Lindholm.

R. pura (Alder). 149. Woods and shady places; generally distributed. Europe, Faroes and Scandinavia (66° N.) to Catalonia, Sardinia, central Italy and Transcaucasia. U. Pleistocene.

R. nitidula (Draparnaud). 153. Woods, hedges, marshes, etc.; generally distributed. Europe, Faroes, Scandinavia (66° N.) and Lithuania to Portugal and Transcaucasia (not Balkans). M. Pleistocene.

ZONITOIDES Lehmann.

Z. excavatus (Alder). 86 + *10*. Woods, etc., on non-calcareous soil, local. Extends north to Outer Hebrides; absent from considerable areas in E. and central England, E. and N. Scotland, N.E. and central Ireland.

N. Belgium, Holland, N.W. Germany (see *Basteria* **14,** 44). M. Pleistocene.

Z. nitidus (Müller). 134 + *3*. Marshes, river banks and wet places generally; extends north to Outer Hebrides. Holarctic; alien in Australia. Cromerian.

Family **Vitrinidae.**

VITRINA Draparnaud.

VITRINA *s.s.*

V. pellucida (Müller). 153. More or less ubiquitous. Europe; central and N. Asia; Iceland and Greenland (*V. angelicae* Beck); *V. limpida* Gould, N. America, closely allied. U. Pleistocene.

PHENACOLIMAX Stabile.

V. major (Férussac). 7 + *1*. Old woodland, rare and local. Devon, Somerset, Bucks, Gloucester, Hereford, Monmouth, Brecon; doubtful record for Northumberland. Europe, W. Germany to Catalonia and Italy.

SEMILIMAX Gray.

***V. pyrenaica** (Férussac) [*V. hibernica* Taylor]. 2. Woodland. Ireland, neighbourhood of Collon, Monasterboice and Mellifont Abbey, Louth and Meath. Pyrenees.

Family **Limacidae.**

MILAX Gray.

M. gagates (Draparnaud). 116 (?). Wild grassy places, especially near sea, in the west, elsewhere mostly in gardens; rare in N. Scotland but extends to Hebrides and Orkney. Some of the records prior to 1930 may possibly refer to *M. budapestensis*; of Ireland Stelfox writes, " I would trust all the old records." S.W. and W. Europe north to Holland; Mediterranean region, Atlantic Isles; alien in America, S. Africa, Australia and Tasmania. Pleistocene (the fossil records of slugs are taken from Kennard & Woodward, 1926).

M. sowerbyi (Férussac). 114 (?). Wild places in S.W., elsewhere mostly in gardens. Not common north of Yorkshire; extends north to Aberdeen; of Ireland Stelfox writes, " Old records certainly not founded on *gracilis*." Europe, Holland to Portugal, Italy and Greece. Pleistocene.

M. budapestensis (Hazay) [*Limax gracilis* Leydig (*non* Rafinesque)]. 39. Gardens and cultivated fields. England and Wales, Cornwall to Northumberland, chiefly western, also S.E. England; Outer Hebrides; local in S. Ireland, chiefly in S.W. Central Europe, Bavaria to Apennines and east to Bulgaria and Crimea. See *J. Conchol.* **19,** 65.

LIMAX Linnaeus.

MALACOLIMAX Malm.

L. tenellus Müller. 29 + *3*. Old woodland, uncommon. Great Britain. Europe, Norway (about 70° N.) to France, Macedonia and Russia.

LIMAX *s.s.*

L. maximus L. 151 + *2*. Woods, wild places, gardens, sometimes in buildings; generally distributed. Europe north to 60° N., but not native in northern countries; Algeria, Atlantic Isles; Asia Minor; alien in N. America, S. Africa, Australia, Tasmania and New Zealand. Pleistocene.

L. cinereoniger Wolf. 84. Old woodland, uncommon. Extends north to Sutherland, but absent from considerable areas in E. England, S. Scotland and central Ireland. Europe (not Iceland) from within Arctic Circle in Norway and 64° 30′ N. in Finland to N.E. Spain, Italy, Sardinia, Greece and Crimea; Atlantic Isles.

LIMACUS Lehmann.

L. flavus L. 111. In and about dwellings, "domesticated to about the same degree as the house mouse or cricket" (Boycott, 1934, 19), occasionally in wild places in S.W. England, more commonly in Ireland. Generally distributed, sparsely in Scotland. Europe east to Transcaucasia, north to Denmark and Estonia (not native in north); Mediterranean region, Atlantic Isles, N. Africa; Syria, Asia Minor; alien in America, S. Africa, Japan, Australia, Tasmania, New Zealand, etc.

LEHMANNIA Heynemann.

L. marginatus Müller [*L. arborum* Bouchard-Chantereaux]. 147 + *2*. Woods, cliffs, rocks, mountains, etc.; generally distributed. Europe, Iceland, Faroes and Norway (71° N.) to France, N. Italy, Thessaly and W. Russia; Newfoundland; alien in Australia and New Zealand. Pleistocene.

AGRIOLIMAX Mörch. [Some authors have recently brought *Deroceras* Rafinesque into use for this genus, on extremely tenuous grounds; application has been made to the International Commission on Zoological Nomenclature to suppress this fantastic name and place *Agriolimax* on the Official List.]

A. agrestis (L.). 1 + *1*. Marshes by Norfolk broads (*J. Conchol.* **21,** 238; *Trans. Norf. & Norw. Nat. Soc.* **16,** 388; Quick, 1949, 26); North Uist, immature (unconfirmed). Europe, north to Iceland, Faroes and Finmark.

A. reticulatus (Müller) [*A. agrestis* of British authors before 1941]. 155. Ubiquitous. Palaearctic region; probably introduced in N. Europe and Iceland; alien in N. America, Peru, S. Africa, Australia, Tasmania, New Zealand, etc. Pleistocene.

A. caruanae Pollonera. 10 + *1*. Gardens and cultivated fields; probably native in S.W. and introduced elsewhere. Mediterranean, Canary Islands; alien in California. [The identity of this slug has not been satisfactorily settled; see Watson (1943, 55), Quick (1949, 28)].

A. laevis (Müller). 146 + *2*. Marshes, watersides and damp places, wet woods, greenhouses, generally distributed. Holarctic and more or less cosmopolitan. Pleistocene.

Class **BIVALVIA.**

[Lamellibranchia ; Pelecypoda.]

Order EULAMELLIBRANCHIATA.

Family **Margaritiferidae.**

MARGARITIFERA Schumacher [*Margaritana* Schumacher].

†**M. auricularia** (Spengler) [*Unio sinuata* Lamarck]. Dredged together with Neolithic implements from R. Thames, Mortlake to Battersea. Living in Spain, France, Belgium, N. Italy, Morocco ; formerly in Germany and central Italy.

M. margaritifera (L.). 75 + *7*. Soft water rivers. England and Wales, " to the north of a line from Scarborough to Beer Head " (Boycott, 1936, 133) ; Scotland, except E. Lowlands ; Ireland, except central limestone plain and Shannon basin ; see *J. Conchol.* **17,** 195, 270. Holarctic (not Mediterranean region). Holocene.

[*M. durrovensis* Phillips is a calcareous water phase (*J. Conchol.* **23,** 6).]

Family **Unionidae.**

UNIO Philipsson [*Lymnium* Oken].

U. pictorum (L.). 46 + *3*. Hard water ; rivers, canals, lakes, large ponds. England, west to Exeter canal, rare in north ; Wales, Brecon and Montgomery. Europe north to Sweden (60° N.) and Archangel ; in Mediterranean region confined to Rhone system, N. Africa and Black Sea rivers ; Siberia east to Amur. Cromerian.

U. tumidus Philipsson. 40 + *1*. Hard water ; slow rivers and canals. England, Somerset and Kent to Yorkshire, not in East Anglia (doubtful record for Norfolk) ; Wales, Brecon and Montgomery. W. and central Europe north to Sweden (61° N.) and Finland ; W. Asia ; subspecies *borysthenensis* Kobelt in lower Danube system, Black Sea rivers and S. Russia. Cromerian.

ANODONTA Lamarck.

A. cygnea (L.). 84 + *14*. Hard water ; rivers, canals, lakes, large ponds. Generally distributed in England (not Cornwall) ; S. Wales, Montgomery and Anglesey ; local in Scotland and absent from N. and N.W. ; most of the Scottish records need confirmation owing to confusion with *A. anatina* ; widely distributed in Ireland except S. and S.W. Palaearctic region. Cromerian.

A. anatina (L.). 68 + *1*. Hard water ; rivers, canals, large ponds, preferring flowing water. Distribution in Great Britain much the same as that of *A. cygnea*, but apparently more local in Scotland ; some of the Scottish records for *A. cygnea* may pertain to *A. anatina* ; Ireland, R. Shannon. Palaearctic region. Cromerian.

A. minima Millet [? *A. complanata* Rossmässler ; *A. elongata* Holandre ; *Pseudanodonta rothomagensis* Locard]. 16. Rivers, sometimes canals. Local in England, Surrey to Yorkshire. Europe, Sweden and Finland to France and W. Russia. M. Pleistocene.

Family **Sphaeriidae.**

SPHAERIUM Scopoli [*Cyclas* Lamarck].

SPHAERIUM *s.s.*

S. rivicola (Lamarck). 39 + *6*. Hard water; rivers and canals. Widely distributed in England; Wales, Brecon and Montgomery. Europe, France north to Estonia and east to Bulgaria and Urals. Cromerian.

S. corneum (L.). 142 + *1*. Rivers, canals, lakes, ponds, marsh drains, etc.; generally distributed. Europe, Lapland (70° N.) and Archangel to Spain, Tuscany, Bulgaria and Caucasus; Siberia; N. America. Norwich Crag.

MUSCULIUM Link.

*__S. transversum__ (Say) [*S. pallidum* Gray; *S. ovale* Jeffreys (*non* Férussac)]. 19 + *5*. Canals and canalised rivers in England and Montgomery in Wales. N. America.

S. lacustre (Müller). 101 + *2*. Ponds, marsh drains, canals, slow rivers. "Rather less widespread than *S. corneum* and strangely rare in Ireland, and tends to be found more in stagnant and less in running water" (Boycott, 1936, 135). Generally distributed in England and Wales; central Scotland north to Perth and in E. Ross; in Ireland absent from S.W., N.W. and several central counties. Europe, S. Sweden, and S. Finland to Portugal, Sardinia, Corsica, central Italy, Bulgaria, Caucasus and Urals; N. Asia to Amur; N. America. U. Pleistocene.

PISIDIUM C. Pfeiffer.

P. amnicum (Müller). 102. Hard water; rivers, streams, canals, lowland lakes. Generally distributed in England; in Wales mainly eastern; E. and central Scotland north to Perth; general in Ireland, except N.W. and S.W. Holarctic (to 69° N.). Norwich Crag. [The Rev. H. B. Herrington has pointed out the similarity between *P. amnicum* var. *sulcata* Wood, from Pleistocene of Grays, Essex, and *P. dubium* (Say), N. America].

P. casertanum (Poli) [*P. cinereum* Alder]. 146 + *2*. Ubiquitous in all kinds of fresh water. Holarctic; identical or very similar forms found in Azores, E. and S. Africa, India, Tasmania and New Zealand. Norwich Crag. Var. *ponderosa* Stelfox, which inhabits large rivers, canals and lakes, has been raised to specific rank by some Continental authors.

P. conventus Clessin. 6. Normal habitat mountain lakes, but not necessarily at high altitudes, the essential factor being low temperature. Lake District, Caernarvon, Perth, Inverness, Kerry; see *J. Conchol.* **19**, 274. N. and alpine Europe (to above 73° N.); Siberia; N. America.

P. personatum Malm. 135 + *3*. Swamps, ditches, pools, mountain lakes; generally distributed. Europe, Faroes, S. Scandinavia and Latvia to Mediterranean; N. Africa. M. Pleistocene.

P. obtusale (Lamarck). 123 + *6*. Ponds, ditches, swamps, peaty pools, sometimes in rivers, streams, canals and lakes. Generally distributed. Europe south to France, Corsica, N. Italy and Transylvania;

Siberia; N. America. M. Pleistocene. Var. *lapponica* Clessin, which occurs in Lough Neagh and the Holocene at Nazeing and Killough, has been raised to specific rank by some Continental authors.

P. milium Held. 140 + *1*. Ponds, tarns, canals, rivers, marsh drains; generally distributed. Europe south to France, N. Italy and Transcaucasia; N. America. Cromerian.

P. pseudosphaerium Favre [*P. favrei* Kuiper]. 2. Marsh drains, Glastonbury, Somerset, and Pevensey, Sussex. France, Holland, Germany, Switzerland; Holocene of Denmark. See *J. Conchol.* **23,** 27.

P. subtruncatum Malm. 140. Rivers, streams, canals, lakes, ponds, marsh drains; generally distributed. Europe north to 65° 30′, east to E. Russia; N. Africa; N. America. Cromerian.

P. supinum Schmidt. 27 + *1*. Slow rivers and canals. England, Kent and Somerset to Yorkshire (not East Anglia). Europe, France to Scandinavia (60° N.) and E. Russia; L. Baikal; N. America. Cromerian; ? Pleistocene of R. Suir, Ireland.

P. henslowanum (Sheppard). 90 + *1*. Hard water; rivers, streams, canals, lakes, ponds, marsh drains. Generally distributed in England; in Wales mainly eastern; Scotland north to Perth, also Caithness and Shetland; in Ireland "more or less confined to the central plain and offshoots thereof, but also occurs in L. Neagh basin" (Stelfox, 1929, 9). Europe, Faroes, N. Scandinavia and Finland to Catalonia, N. Italy and E. Russia; L. Baikal; N. America. Coralline Crag.

P. lilljeborgi Clessin. 57. Lakes, chiefly mountain lakes, occasionally in canals. N. England; N. Wales and Glamorgan; widely distributed in Scotland; Ireland, mainly N., W. and S.W. N. and alpine Europe, Iceland, Faroes, Scandinavia, Denmark, Latvia, Lithuania, Germany, E. Tyrol, Switzerland, Spain (Algeciras); L. Baikal, Japan; *P. mitchelli* Prashad, Kashmir, probably identical; N. America. Cromerian.

P. hibernicum Westerlund. [*P. ferrugineum* Prime, *teste* Herrington]. 108 + *1*. Ponds, marsh drains, streams, rivers, canals, lakes, tarns. Generally distributed, less frequent in south; see *Irish Naturalist* **27,** 33, and *Proc. Malac. Soc.* **14,** 215. Europe, Faroes, Scandinavia, and Finland to France, N. Italy and Russia; W. Siberia; N. America. M. Pleistocene.

P. nitidum Jenyns. 144 + *1*. Ponds, lakes, marsh drains, rivers, streams, canals. Generally distributed, less frequent in N. and W. Europe, Faroes and Scandinavia (70° N.) to Mediterranean; N. America. Cromerian.

P. pulchellum Jenyns. 77 + *5*. Ponds, rivers, streams, canals. Widely but rather sporadically distributed. Europe, Faroes, Scandinavia and Finland to Catalonia and Urals. Cromerian.

P. moitessierianum Paladilhe [*P. parvulum* Johansen (*non* Clessin); *P. torquatum* Stelfox]. 23. Rivers and canals. England, Surrey and Wiltshire to Yorkshire, and Cornwall (Bude canal); Montgomery in Wales; Ireland, Antrim, Dublin, Galway and Tipperary. Europe, S. Sweden and Finland to S. France, Austria and Russia; L. Baikal. Cromerian; ? Pleistocene of rivers Suir, Barrow, Nore and Shannon in Ireland.

P. tenuilineatum Stelfox. 5. Rivers and canals, rare. Berkshire, Oxford, Buckingham, Northampton, Shropshire. Europe, S. Sweden, Holland, Germany, Switzerland, Bohemia, Croatia. M. Pleistocene.

†**P. vincentianum** Woodward. Holocene, Killough, Co. Down, U. Pleistocene, Sittingbourne, E. Kent. Living in Sicily, Corfu, Greece (Prevesa, Euboea), Persia and Turkistan. Pleistocene of Normandy, Belgium, Holland, Germany, Switzerland; Holocene of Denmark and Germany.

Family **Dreissenidae.**

DREISSENA van Beneden.

D. polymorpha (Pallas). 42 + *2*. Rivers, canals, docks, reservoirs, water-mains. England, Somerset and Surrey to Yorkshire, and Exeter canal; central Scotland; first observed in England in 1824, in Scotland about 1830. S. Russia, dispersed during nineteenth century through central Europe to Denmark, Holland, Belgium and France, and recently to S. Sweden. Holocene; in last interglacial period extended to Denmark, N. Germany and N. France.

GREENHOUSE ALIENS.

The following exotic species have been recorded from greenhouses, but have not become naturalized in the open.

Lymnaea (Galba) cubensis Pfeiffer. Glasnevin, Dublin (Meeuse & Hubert, 1949, 12). Central America, southern U.S.A., West Indies.

L. (Galba) humilis Say, subsp. **rustica** Lea. Specimens collected by Mr. Hugh Watson in the botanic garden at Cambridge appear to be this subspecies. N. America.

Lymnaea spp. Undetermined *Lymnaea* resembling *L. truncatula* have been found in botanic gardens at Kew, Edinburgh and Glasnevin.

L. (Pseudosuccinea) columella Say [? = *L. peregrina* Clessin]. Edinburgh (Meeuse & Hubert, 1949, 10). N. America; greenhouses in Belgium, Holland, Denmark, Germany and Poland; *L. peregrina* is S. American.

Physastra dispar Tapparone Canefri. Swansea, Glamorgan. Australia.

Helisoma (Seminolina) duryi (Wetherby). Kew (det. H. A. Pilsbry). N. America. Undetermined alien Planorbidae have been reported from Kew, Oxford and London (Zoological Gardens).

Pleurodiscus balmei (Potiez & Michaud) [*P. flavidus* (Rossmässler)]. Glasnevin. Sicily, Malta, Lebanon.

Subulina octona (Bruguière). Various localities. Tropical America; introduced in Africa, Ceylon, East Indies, etc.

S. striatella (Rang) [*S. petrensis* (Morelet)]. Kew, Glasgow, ? Bristol (*J. Conchol.* **23,** 53). W. Africa.

Lamellaxis (Allopeas) clavulinus (Potiez & Michaud) [*Leptinaria urichi* (Smith)]. Kew, Cambridge, Nottingham, Edinburgh. Indian Ocean, Japan, Hawaii.

L. (Allopeas) mauritianus (L. Pfeiffer). Belfast (Meeuse & Hubert, 1949, 18). Tropics (original home unknown); greenhouses in temperate countries.

Opeas pumilum (L. Pfeiffer) [*Bulimus clavulus* Turton; ? *Helix goodalli* Miller (see *J. Conchol.* **23,** 53)]. Numerous localities. Tropical America, now widely dispersed.

Opeas (Synopeas) beckianum (Pfeiffer). York (*J. Conchol.* **18,** 31). Central and S. America, West Indies.

Rumina decollata (L.). Waddeton Court, Stoke Gabriel, S. Devon, 1826. Mediterranean region; introduced in N. America, Cuba, etc.

Gulella devia Connolly. Edinburgh. Uganda. See *Ann. & Mag. Nat. Hist.* (10) **8,** 310.

Helicodiscus parallelus (Say). Cambridge; Ireland: Castlewellan and Hillsborough, Co. Down, Glasnevin, Cork. N. America. [For list of introduced aliens in Ireland see Stelfox (1911, 131).]

Hawaiia minuscula (Binney). Cambridge, Nottingham, Belfast. N. America; introduced in West Indies, Bermuda, Pacific Islands, Japan, etc.

Zonitoides (Zonitellus) arboreus (Say). Kew, Cambridge, Northwich, Cheshire, Edinburgh, Belfast, Glasnevin. N. and Central America; introduced in many parts of the world.

Limax nyctelius Bourguignat. Glasgow, Edinburgh. Algeria, Morocco; alien in S. Africa (*Ann. S. Afr. Mus.* **33,** 176).

Limax (Ambigolimax) poirieri Mabille [? = *L. valentianus* Férussac]. Swansea, Belfast. Iberian peninsula, Canary Islands; alien in N. America.

ADVENTIVES.

The following species have been recorded as casual or adventitious introductions, but have not become established.

Cochlostoma septemspirale (Razoumowsky). Kearsney near Dover. S. Europe, Pyrenees to Balkans, chiefly in mountainous regions.

C. (Auritus) patulum (Draparnaud). Kearsney (*J. Conchol.* **16,** 51). S. Europe, S. France to Dalmatia.

Chondrina (Solatopupa) similis (Bruguière). Lancashire. France, Spain, Corsica, Italy, Sicily.

Jaminia quadridens (Müller). Whitlingham near Norwich, Hammersmith. W. Europe north to Rhineland, Mediterranean region.

Zebrina detrita (Müller). Burton-on-Trent, Derby. Europe, E. Spain north to Belgium and Rhineland (also near Berlin), east to Bulgaria; Asia Minor, Syria, N.W. Persia.

Albinaria caerulea (Deshayes). Havant, Hampshire. Morea, Cyclades, Chios.

Clausilia parvula Férussac. Stourbridge, Worcester; specimens in collection of E. W. Bowell labelled "near Cranbrook, Kent". Europe, Pyrenees to E. Holland, Westphalia, Carpathians and Carniola. U. Pleistocene, Woodston, Hunts.

Laciniaria plicata (Draparnaud). Dornoch, Sutherland. Central Europe.

Helix (Otala) lactea Müller. Cardiff, Filey Sands and Pateley Bridge, Yorkshire. Iberian peninsula, N.W. Africa, Canary Islands; introduced in N. America, Argentine and Uruguay. Waltonian Crag, Walton-on-Naze, Essex.

Helix (Eobania) vermiculata Müller. Slateford, Edinburgh; Roman deposit at Kettering, Northants. Mediterranean region; alien in New Orleans.

Helix (Macularia) carthaginiensis Rossmässler. Cardiff. Spain.

Hygromia (Monachoides) umbrosa (Pfeiffer). Margate, Kent; erroneously recorded from Pleistocene at Ightham, Kent. Mountainous regions of central Europe.

Hygromia (Trichia) villosa (Draparnaud). Cardiff. Alpine W. Europe, E. France, Switzerland, S. Germany.

Euomphalia strigella (Draparnaud), subsp. **apennina** (Kobelt). Leith. Italy.

Helicella zaccarensis (Kobelt). Rostrevor, Co. Down. Algeria.

H. vestalis (L. Pfeiffer). Belhaven. Egypt, Syria.

H. (Trochoidea) pyramidata (Draparnaud). Wakefield, Yorkshire. Mediterranean region.

H. (Xeroptycha) tuberculosa (Conrad). Belhaven, Haddington. Palestine, Sinai.

Haplotrema (Ancomena) vancouverense (Lea). Introduced into a garden at Haltwhistle, Northumberland.

Parmacella sp. Newcastle-on-Tyne. Mediterranean region.

BIBLIOGRAPHY.

BOYCOTT, A. E., 1934. The habitats of Land Mollusca in Britain. *J. Ecol.* **22,** 1–38.

BOYCOTT, A. E., 1936. The habitats of Fresh-water Mollusca in Britain. *J. Animal Ecol.* **5,** 116–186.

DRUCE, G. C., 1932. *The Comital Flora of the British Isles.* Arbroath. (With map of vice-counties.)

EHRMANN, P., 1933. *Die Tierwelt Mitteleuropas : Mollusken.* Leipzig.

KENNARD, A. S., 1923. The Holocene non-marine Mollusca of England. *Proc. Malac. Soc.* **15,** 241–259.

KENNARD, A. S., 1924. The Pleistocene non-marine Mollusca of England. *Proc. Malac. Soc.* **16,** 84–97.

KENNARD, A. S., 1937. On the Mollusca from a Holocene tufaceous deposit at Broughton-Brigg, Lincolnshire. *Proc. Malac. Soc.* **22,** 374–379.

KENNARD, A. S., 1941. List of the British non-marine Mollusca. *J. Conchol.* **21,** 260–274.

KENNARD, A. S., 1944. The Crayford Brickearths. *Proc. Geol. Assoc.* **55,** 121–169.

KENNARD, A. S., and WOODWARD, B. B., 1926. *Synonymy of the British non-marine Mollusca.* British Museum (Natural History).

MEEUSE, A. D. J., and HUBERT, B., 1949. The Mollusc Fauna of Glasshouses in the Netherlands. *Basteria* **13,** 1–30.

PRAEGER, R. L., 1896. On the Botanical subdivision of Ireland. *Irish Nat.* **5,** 29–38, pl. 1 (map).

PRAEGER, R. L., 1901. Irish Topographical Botany. *Proc. Roy. Irish Acad.* (3) **7,** i–clxxxviii, 1–410, pl. 1–6 (pl. 1, map of vice-counties).

QUICK, H. E., 1933. The Anatomy of British Succineae. *Proc. Malac. Soc.* **20,** 295–318, pl. 23–25.

QUICK, H. E., 1949. *Synopses of the British Fauna*, no. 8, Slugs. Linnean Society of London.

STELFOX, A. W., 1911. A List of the Land and Freshwater Mollusks of Ireland. *Proc. Roy. Irish Acad.* **29** B, 65–164, pl. 7.

STELFOX, A. W., 1929. Report on recent additions to the Irish Fauna and Flora : Land and Freshwater Mollusca. *Proc. Roy. Irish Acad.* **39** B, 6–10.

TAYLOR, J. W., 1894–1921. *Monograph of the Land and Freshwater Mollusca of the British Isles.* Leeds.

WATSON, H., 1943. Notes on a list of the British non-marine Mollusca. *J. Conchol.* **22,** 13–22, 25–47, 53–72.

WATSON, H. C., 1859. *Cybele Britannica* **4.** London.

WATSON, H. C., 1883. *Topographical Botany,* 2nd edition. London. (Map of vice-counties).

ZEUNER, F. E., 1945. *The Pleistocene Period.* Ray Society. (List of non-marine Mollusca by Day Kimball, pp. 269–273.)

TABLES OF DISTRIBUTION.

In the following tables species known or considered to be aliens of recent introduction are indicated by an asterisk; only those which have become established in the open are included, casual adventives and greenhouse aliens being omitted. Semi-marine species are indicated by a double obelus, and Holocene species not known living in the British Isles by an obelus. Numerals in small type indicate records based on Holocene or dead shells. Numerals in italics indicate that the record requires confirmation, or that the species is an obvious introduction and not a native of that vice-county. In those cases where it is impossible to determine in which areas a species is native or introduced, all authenticated records are printed in roman. In computing the total number of species recorded for each county or vice-county, unsatisfactory and fossil records are excluded, but it has usually been assumed that certain critical species, e.g. those of *Milax* and *Succinea*, were correctly determined.

Statistical Summary.

	ENGLAND.	WALES.	SCOTLAND.	IRELAND.	BRITISH ISLES.*
Number of counties and vice-counties :	61	12	41	40	155
GASTROPODA :	145	115	109	113	148
PROSOBRANCHIA :	16	11	10	10	16
Littoral :	4	2	2	3	4
Terrestrial :	2	2	1	1	2
Freshwater :	10	7	7	6	10
PULMONATA :	129	104	99	103	132
Littoral :	2	2	1	2	2
Terrestrial :	101	80	77	79	104
Freshwater :	26	22	22	22	26
BIVALVIA :	27	22	19	18	27
Total number of species :	172	137	128	131	175

* Including Channel Islands.

		ENGLAND.															
		Peninsula.								Channel.							
NAME OF SPECIES. Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	0. Channel Isles	*1a*. Scilly	1. Cornwall West	2. Cornwall East	3. Devon South	4. Devon North	*4a*. Lundy	5. Somerset South	6. Somerset North	7. Wilts North	8. Wilts South	9. Dorset	10. Isle of Wight	11. Hants South	12. Hants North	13. Sussex West	14. Sussex East
GASTROPODA.																	
Theodoxus fluviatilis	...	...	*1*	...	*3*	...	...	5	6	7	8	9	...	11	...	13	14
Viviparus viviparus	...	...	...	...	3	...	...	...	6	7	8	...	...	11	12	13	...
V. fasciatus	...	...	...	...	...	...	...	...	*6*	...	...	9	...	11	...	...	...
Valvata cristata	...	...	...	...	3	...	...	5	6	7	8	9	...	11	12	13	14
V. macrostoma	...	...	...	...	...	...	...	...	...	...	...	...	...	11	...	...	14
V. piscinalis	...	...	1	...	3	4	...	5	6	7	8	9	10	11	12	13	14
Pomatias elegans	*0*	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
Acme fusca	...	...	*1*	...	3	4	...	5	*6*	...	8	9	*10*	...	...	13	14
‡Hydrobia ventrosa	0	*1a*	*1*	...	*3*	...	...	5	6	...	...	9	10	11	...	13	14
‡H. ulvae	...	...	1	2	3	4	...	5	6	...	...	9	10	11	...	13	14
‡Pseudamnicola confusa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	13	...
Potamopyrgus jenkinsi	0	...	1	2	3	4	...	5	6	7	*8*	9	10	11	12	13	14
Bythinella scholtzi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bithynia tentaculata	...	...	1	...	3	4	...	5	6	7	8	9	10	11	12	13	14
B. leachi	...	...	...	...	*3*	...	...	5	6	7	8	*9*	*10*	11	12	...	14
‡Assiminea grayana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Carychium minimum *agg*.	0	...	1	...	3	4	4*a*	5	6	7	8	9	10	11	...	13	14
C. minimum *seg*.	...	...	1	2	3	...	...	...	...	...	8	9	...	...	12	13	14
C. tridentatum	...	...	1	2	...	...	...	...	6	7	8	9	10	...	12	13	14
‡Leucophytia bidentata	0	...	*1*	...	3	4	...	5	...	...	...	9	...	...	...	...	...
‡Phytia myosotis	*0*	...	1	...	3	4	4*a*	...	6	...	...	9	10	11	...	13	14
Lymnaea truncatula	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
L. glabra	0	...	1	2	*3*	...	...	...	*6*	7	*8*	9	...	11	...	13	14
L. palustris	0	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
L. stagnalis	...	...	...	...	*3*	...	...	5	6	7	8	9	*10*	11	12	13	14
L. auricularia	...	...	*1*	...	3	4	...	5	6	7	8	*9*	10	11	...	13	14
L. peregra	0	1*a*	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
L. glutinosa	...	...	*1*	...	...	...	...	*5*	...	...	*8*	*9*	...	...	...	...	...
Aplexa hypnorum	0	...	1	...	3	4	...	5	6	7	8	9	*10*	11	12	13	14
Physa fontinalis	...	...	*1*	...	3	4	...	5	6	7	8	9	10	11	12	13	14
*Physa *spp*.	...	...	...	...	3	...	...	...	6	...	...	9	...	...	...	...	...
Planorbarius corneus	...	...	...	...	3	...	...	...	6	7	8	9	...	11	12	13	14
Menetus dilatatus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Planorbis carinatus	...	...	...	...	3	...	...	5	6	7	8	9	*10*	11	12	13	14
P. planorbis	*0*	...	...	...	3	4	...	5	6	7	8	9	*10*	11	12	13	14
P. vorticulus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	13	14
P. vortex	0	*1a*	...	2	3	*4*	...	5	6	7	8	9	10	11	12	13	14
P. leucostoma	0	1*a*	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
P. laevis	*0*	...	*1*	...	3	...	...	...	6	7	*8*	9	...	...	...	13	...
P. albus	...	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
P. acronicus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. crista	0	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
P. contortus	...	...	...	...	3	4	...	5	6	7	8	9	10	11	12	13	14
Segmentina complanata	...	...	...	...	3	...	...	5	6	7	8	9	10	11	12	13	14
S. nitida	...	...	...	...	...	...	...	...	...	7	*8*	*9*	...	11	12	...	14
Acroloxus lacustris	...	...	...	...	3	...	...	...	6	7	8	9	10	11	12	13	14
Ancylus fluviatilis	0	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14

ENGLAND.																		
Thames.										Ouse.								**NAME OF SPECIES.**
15. Kent East	16. Kent West	17. Surrey	18. Essex South	19. Essex North	20. Herts	21. Middlesex	22. Berks	23. Oxford	24. Bucks	25. Suffolk East	26. Suffolk West	27. Norfolk East	28. Norfolk West	29. Cambridge	30. Bedford	21. Hunts	32. Northampton	Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
																		GASTROPODA.
15	16	17	18	19	20	21	22	23	24	25	26	27	*28*	29	30	31	32	Theodoxus fluviatilis
15	16	17	18	19	20	21	22	23	24	25	*26*	27	*28*	...	*30*	31	32	Viviparus viviparus
...	*16*	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	V. fasciatus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Valvata cristata
...	...	...	...	...	...	...	...	*23*	...	...	26	27	28	29	...	31	...	V. macrostoma
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	V. piscinalis
15	16	17	...	19	20	21	22	23	24	25	26	27	28	29	*30*	31	32	Pomatias elegans
15	16	17	...	19	20	...	22	23	24	25	*26*	*27*	28	...	...	...	32	Acme fusca
15	16	17	18	19	...	21	...	...	...	25	...	27	28	29	...	...	...	‡Hydrobia ventrosa
15	16	...	18	19	...	...	...	...	...	25	...	27	28	...	...	...	...	‡H. ulvae
...	16	...	*18*	...	...	...	...	...	...	25	...	27	...	29	...	...	...	‡Pseudamnicola confusa
15	16	17	18	19	20	21	22	23	24	25	...	27	28	29	...	...	32	Potamopyrgus jenkinsi
...	...	17	...	...	...	...	...	...	...	...	...	...	...	29	...	31	...	Bythinella scholtzi
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Bithynia tentaculata
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	B. leachi
15	16	...	18	19	...	...	...	...	...	25	...	27	28	...	...	...	...	‡Assiminea grayana
15	...	...	18	...	20	21	...	23	24	25	26	...	28	29	...	31	32	Carychium minimum *agg.*
15	16	17	18	19	...	21	22	...	24	25	...	27	...	29	30	...	32	C. minimum *seg.*
15	16	17	18	19	20	21	22	23	24	25	...	27	28	29	30	31	32	C. tridentatum
...	16	...	18	19	...	...	...	...	...	25	...	...	*28*	...	...	...	...	‡Leucophytia bidentata
15	16	...	18	19	...	...	...	...	...	25	...	27	28	...	...	...	...	‡Phytia myosotis
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Lymnaea truncatula
15	16	...	18	19	20	...	22	...	...	25	...	...	28	...	...	...	...	L. glabra
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	L. palustris
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	L. stagnalis
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	L. auricularia
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	L. peregra
15	...	17	18	19	...	21	22	23	24	25	*26*	27	...	29	...	*31*	...	L. glutinosa
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Aplexa hypnorum
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Physa fontinalis
...	16	17	...	...	20	21	...	23	24	25	...	...	...	...	...	...	32	*Physa *spp.*
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Planorbarius corneus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Menetus dilatatus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Planorbis carinatus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. planorbis
...	...	...	...	...	...	...	...	...	...	*25*	26	27	...	29	...	...	...	P. vorticulus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. vortex
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. leucostoma
15	*16*	*17*	18	19	*20*	21	22	23	...	25	...	27	...	29	30	...	...	P. laevis
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. albus
...	...	17	18	...	20	21	22	23	24	...	...	...	...	...	...	...	...	P. acronicus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. crista
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. contortus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Segmentina complanata
15	16	17	18	*19*	20	21	22	23	*24*	25	26	27	28	29	...	31	32	S. nitida
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Acroloxus lacustris
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Ancylus fluviatilis

NAME OF SPECIES.		ENGLAND.															
		Peninsula.								Channel.							
Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	0. Channel Isles	1*a*. Scilly	1. Cornwall West	2. Cornwall East	3. Devon South	4. Devon North	4*a*. Lundy	5. Somerset South	6. Somerset North	7. Wilts North	8. Wilts South	9. Dorset	10. Isle of Wight	11. Hants South	12. Hants North	13. Sussex West	14. Sussex East
Catinella arenaria	0	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...
Succinea oblonga	...	...	...	...	...	...	...	...	*6*	...	...	...	...	...	...	13	14
S. putris	0	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
S. pfeifferi	0	1*a*	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
S. elegans	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*14*
Azeca goodalli	...	...	1	...	...	4	...	...	6	7	8	*9*	...	11	12	13	14
Cochlicopa lubrica	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
Pyramidula rupestris	0	...	1	2	3	...	...	5	6	7	8	9	10	11	...	13	14
Columella edentula	0	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	*13*	14
Truncatellina cylindrica	...	...	...	...	...	...	...	...	*6*	...	8	...	...	...	...	...	...
T. cylindrica britannica	...	...	...	...	3	...	...	...	...	...	...	9	10	...	...	...	...
Vertigo pusilla	...	...	...	...	*3*	4	...	...	...	7	...	9	10	11	...	...	...
V. antivertigo	0	...	1	2	3	4	...	...	6	7	8	9	*10*	11	...	*13*	14
V. substriata	0	...	1	...	3	4	4*a*	...	...	7	*8*	9	10	11	...	13	...
V. pygmaea	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
V. genesii	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
†V. parcedentata	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. moulinsiana	...	...	...	...	...	4	...	...	...	...	8	9	10	11	...	13	...
V. lilljeborgi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. alpestris	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. angustior	...	...	...	...	...	...	...	...	6	7	...	...	...	...	...	...	...
Pupilla muscorum	0	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
Lauria cylindracea	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
L. anglica	0	...	1	2	*3*	...	4*a*	...	6	7	...	...	10	...	...	...	...
Abida secale	...	...	1	...	3	...	...	...	6	7	8	9	10	...	*12*	13	14
Acanthinula aculeata	0	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
A. lamellata	...	...	...	...	...	...	...	...	...	7	...	...	...	...	...	...	...
Vallonia costata	...	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
V. pulchella *agg*.	0	1*a*	1	2	...	4	...	5	6	...	...	...	...	...	...	...	...
V. pulchella *seg*.	...	...	1	2	3	...	...	...	...	7	8	9	10	11	12	13	14
V. excentrica	...	1*a*	1	...	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
Ena montana	...	...	...	...	*3*	...	...	...	6	7	8	9	...	11	12	13	...
E. obscura	0	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
Marpessa laminata	...	...	...	...	3	4	...	5	6	7	8	9	10	11	12	13	14
Clausilia bidentata	0	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
C. dubia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C. rolphi	...	...	...	...	3	*4*	...	...	6	7	8	9	...	11	12	13	14
Laciniaria biplicata	...	...	...	...	...	...	...	5	*6*	7	8	...	...	...	*12*	...	...
Balea perversa	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
Cecilioides acicula	*0*	...	...	2	3	4	...	5	6	7	8	9	10	11	12	13	14
Testacella maugei	0	1*a*	1	...	3	4	...	5	6	7	8	9	...	11	*12*	13	...
T. haliotidea	...	...	...	...	3	4	...	...	...	...	8	*9*	10	11	...	13	14
T. scutulum	0	...	...	...	3	...	...	5	...	...	...	9	10	11	...	13	14
Fruticicola fruticum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Helicodonta obvoluta	...	...	...	...	...	...	...	...	...	...	8	...	...	11	12	13	...
Helicigona lapicida	...	...	*1*	...	3	4	...	5	6	7	8	9	10	11	12	13	14
Arianta arbustorum	...	*1a*	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14

ENGLAND.																		Name of Species. Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation or adventitious introductions.*
Thames.										**Ouse.**								
15. Kent East	16. Kent West	17. Surrey	18. Essex South	19. Essex North	20. Herts	21. Middlesex	22. Berks	23. Oxford	24. Bucks	25. Suffolk East	26. Suffolk West	27. Norfolk East	28. Norfolk West	29. Cambridge	30. Bedford	21. Hunts	32. Northampton	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Catinella arenaria
15	16	17	...	...	...	...	...	...	...	...	...	...	...	29	...	...	...	Succinea oblonga
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	S. putris
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	S. pfeifferi
15	*16*	17	*18*	*19*	20	...	...	23	...	*25*	...	27	...	...	...	...	...	S. elegans
15	16	17	...	19	20	*21*	22	23	24	25	26	27	...	...	30	...	32	Azeca goodalli
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Cochlicopa lubrica
15	16	17	*18*	*19*	20	...	22	23	*24*	...	...	...	...	*29*	30	*31*	32	Pyramidula rupestris
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	...	32	Columella edentula
15	*16*	17	...	...	...	21	...	...	...	*25*	...	...	28	29	...	...	...	Truncatellina cylindrica
...	16	...	...	...	...	...	...	...	...	...	...	...	28	...	...	...	...	T. cylindrica britannica
15	16	17	18	19	20	...	22	23	24	25	26	27	28	...	...	...	32	Vertigo pusilla
15	16	17	18	19	20	21	22	23	...	25	26	27	28	29	30	*31*	32	V. antivertigo
15	16	17	18	19	20	...	22	...	24	25	26	27	28	...	30	...	32	V. substriata
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	V. pygmaea
...	...	...	18	...	20	...	...	...	...	...	...	...	...	...	...	...	32	V. genesii
...	...	...	...	19	20	...	...	...	...	...	...	...	...	...	...	...	32	†V. parcedentata
...	...	17	...	*19*	20	21	22	*23*	...	25	26	27	...	29	...	...	*32*	V. moulinsiana
...	...	...	...	...	...	...	...	...	24	...	...	...	...	...	...	...	...	V. lilljeborgi
...	...	...	...	19	...	...	...	...	...	...	...	...	...	...	...	...	...	V. alpestris
...	16	*17*	18	19	20	...	...	...	...	25	*26*	27	*28*	29	30	...	32	V. angustior
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Pupilla muscorum
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Lauria cylindracea
...	16	...	...	19	...	...	...	...	24	...	...	...	...	29	...	...	...	L. anglica
15	...	...	...	...	20	21	*22*	23	24	...	...	...	...	...	...	...	...	Abida secale
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Acanthinula aculeata
15	16	...	18	19	20	...	*22*	...	24	...	...	...	...	...	...	...	...	A. lamellata
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Vallonia costata
15	...	...	18	...	...	...	22	...	24	...	...	...	28	...	...	31	...	V. pulchella *agg.*
15	16	17	18	19	20	21	22	23	...	25	26	27	28	29	30	31	32	V. pulchella *seg.*
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	V. excentrica
...	...	17	...	19	20	...	22	23	24	...	26	...	...	...	30	...	32	Ena montana
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	E. obscura
15	16	17	18	19	20	*21*	22	23	24	25	26	27	28	29	30	31	32	Marpessa laminata
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Clausilia bidentata
15	...	...	*18*	...	*20*	...	...	*23*	...	*25*	...	...	...	...	...	...	...	C. dubia
15	16	17	*18*	19	20	21	22	...	...	...	...	...	...	...	30	...	32	C. rolphi
...	*16*	17	18	...	20	21	...	...	...	...	...	...	...	29	...	...	...	Laciniaria biplicata
15	16	17	18	19	20	*21*	22	23	24	25	26	27	28	29	30	31	32	Balea perversa
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Cecilioides acicula
...	...	17	...	...	...	21	22	23	...	...	...	...	...	...	30	...	...	Testacella maugei
15	16	17	18	...	20	21	22	23	24	25	*26*	27	28	29	30	31	32	T. haliotidea
15	16	17	18	...	20	21	22	23	24	*25*	...	27	28	...	30	...	32	T. scutulum
15	16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Fruticicola fruticum
...	...	17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Helicodonta obvoluta
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Helicigona lapicida
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Arianta arbustorum

Name of Species. Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	0. Channel Isles	ENGLAND.															
		Peninsula.								Channel.							
		1*a*. Scilly	1. Cornwall West	2. Cornwall East	3. Devon South	4. Devon North	4*a*. Lundy	5. Somerset South	6. Somerset North	7. Wilts North	8. Wilts South	9. Dorset	10. Isle of Wight	11. Hants South	12. Hants North	13. Sussex West	14. Sussex East
Theba pisana	0	...	1	...	...	*4*	...	...	...	...	...	*9*	...	...	...	...	*14*
Helix hortensis	*0*	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
H. nemoralis	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
H. aspersa	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
H. pomatia	...	...	...	...	...	...	...	...	6	7	8	*9*	...	...	12	13	...
*Hygromia limbata	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...
*H. cinctella	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...
H. subrufescens	...	1*a*	1	2	3	4	...	5	6	7	*8*	9	*10*	11	12	13	*14*
H. striolata	...	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
H. hispida	0	1*a*	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
H. liberta	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H. subvirescens	0	1*a*	1	2	3	4	4*a*	...	6	...	...	...	...	...	...	...	...
Monacha granulata	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
M. cartusiana	...	...	...	...	...	...	...	...	*6*	...	...	...	...	11	...	13	14
M. cantiana	...	...	*1*	...	3	4	...	5	6	7	8	9	10	11	12	13	14
Helicella caperata	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
H. gigaxi	...	...	...	...	...	...	...	...	6	7	8	9	10	11	12	13	14
H. virgata	0	1*a*	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
H. itala	...	1*a*	1	...	3	*4*	...	5	6	7	8	9	10	11	12	13	14
*H. elegans	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cochlicella acuta	0	1*a*	1	2	3	4	...	...	6	7	...	9	10	...	...	13	14
Punctum pygmaeum	0	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
†Discus ruderatus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
D. rotundatus	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
Geomalacus maculosus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Arion intermedius	...	...	1	2	3	4	4*a*	5	*6*	7	8	9	10	11	12	13	14
A. circumscriptus	0	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
A. hortensis	0	1*a*	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
A. subfuscus	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
A. ater *agg.*	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
A. ater *seg.*	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...
A. rufus	...	...	...	...	...	...	...	...	6	...	...	...	...	...	...	...	...
Euconulus fulvus	0	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
Vitrea crystallina	0	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
Oxychilus draparnaldi	0	1*a*	1	2	3	4	...	5	6	...	...	9	10	11	12	13	14
O. cellarius	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
O. alliarius	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
O. helveticus	0	...	1	2	3	4	...	5	6	7	*8*	9	10	*11*	...	13	*14*
†Retinella petronella	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
R. radiatula	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
R. pura	0	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
R. nitidula	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
Zonitoides excavatus	...	...	1	2	3	4	...	5	*6*	...	...	9	10	11	...	13	14
Z. nitidus	0	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
Vitrina pellucida	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
V. major	...	...	...	...	3	...	...	...	6	...	...	...	...	...	...	...	...
*V. pyrenaica	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

ENGLAND.

Thames.										Ouse.								NAME OF SPECIES.
15. Kent East	16. Kent West	17. Surrey	18. Essex South	19. Essex North	20. Herts	21. Middlesex	22. Berks	23. Oxford	24. Bucks	25. Suffolk East	26. Suffolk West	27. Norfolk East	28. Norfolk West	29. Cambridge	30. Bedford	21. Hunts	32. Northampton	Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Theba pisana
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Helix hortensis
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	H. nemoralis
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	H. aspersa
15	16	17	...	19	20	...	...	23	*24*	*25*	26	...	*28*	29	30	...	32	H. pomatia
...	...	...	...	...	...	*21*	...	...	...	...	...	...	...	...	...	...	...	*Hygromia limbata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*H. cinctella
...	16	17	...	...	*20*	...	...	*23*	*24*	...	...	...	...	...	...	...	*32*	H. subrufescens
15	16	17	*18*	19	20	21	22	23	24	25	26	27	28	29	30	31	32	H. striolata
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	H. hispida
...	16	17	18	19	20	21	...	23	...	25	26	...	28	29	30	31	32	H. liberta
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. subvirescens
15	*16*	17	...	19	20	21	22	23	24	25	26	27	28	29	30	*31*	32	Monacha granulata
15	16	*17*	...	19	...	*21*	...	...	*24*	25	*26*	*27*	...	...	...	...	...	M. cartusiana
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	M. cantiana
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Helicella caperata
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	H. gigaxi
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	H. virgata
15	16	17	...	19	20	21	22	23	24	25	26	27	28	29	30	31	32	H. itala
15	...	17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*32*	*H. elegans
15	*16*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Cochlicella acuta
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Punctum pygmaeum
...	...	...	...	19	20	...	...	...	...	25	...	...	...	...	...	...	...	†Discus ruderatus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	D. rotundatus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Geomalacus maculosus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Arion intermedius
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	A. circumscriptus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	A. hortensis
15	16	17	...	19	20	21	22	23	24	...	26	27	28	...	30	31	32	A. subfuscus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	...	30	31	32	A. ater *agg.*
...	16	17	...	...	...	...	...	23	...	...	...	27	...	29	...	...	...	A. ater *seg.*
...	...	...	18	...	...	...	22	...	...	...	...	...	...	29	...	...	...	A. rufus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Euconulus fulvus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Vitrea crystallina
15	16	17	...	...	20	21	...	23	24	25	...	27	28	29	30	*31*	32	Oxychilus draparnaldi
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	O. cellarius
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	O. alliarius
15	16	17	18	19	20	21	22	23	24	25	26	27	...	29	30	31	32	O. helveticus
...	...	...	...	19	...	...	...	...	...	25	...	...	...	...	...	...	...	†Retinella petronella
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	R. radiatula
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	R. pura
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	R. nitidula
15	16	17	...	19	20	...	22	23	24	...	*26*	...	...	...	30	31	*32*	Zonitoides excavatus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Z. nitidus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Vitrina pellucida
...	...	...	...	...	...	...	...	...	24	...	...	...	...	...	...	...	...	V. major
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*V. pyrenaica

NAME OF SPECIES. Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	0. Channel Isles	ENGLAND.															
		Peninsula.								Channel.							
		1*a*. Scilly	1. Cornwall West	2. Cornwall East	3. Devon South	4. Devon North	4*a*. Lundy	5. Somerset South	6. Somerset North	7. Wilts North	8. Wilts South	9. Dorset	10. Isle of Wight	11. Hants South	12. Hants North	13. Sussex West	14. Sussex East
Milax gagates	*0*	1*a*	1	2	3	*4*	4*a*	5	6	7	*8*	9	10	*11*	*12*	13	14
M. sowerbyi	*0*	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	*12*	13	14
M. budapestensis	...	...	...	2	3	...	...	5	6	7	...	9	10	...	...	13	14
Limax tenellus	...	...	...	...	3	...	...	...	...	...	...	...	...	11	...	13	14
L. maximus	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
L. cinereoniger	...	...	...	2	3	4	...	...	...	7	8	...	...	11	12	13	14
L. flavus	...	1*a*	1	2	3	...	4*a*	5	6	7	8	9	10	11	12	13	14
L. marginatus	...	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
Agriolimax agrestis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. reticulatus	0	1*a*	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
A. caruanae	*0*	...	1	...	3	...	...	...	...	...	...	...	...	11	...	...	...
A. laevis	...	...	1	2	3	4	4*a*	5	6	7	8	9	10	11	12	13	14
BIVALVIA.																	
M. margaritifera	...	...	...	2	3	4	...	...	...	...	...	...	...	...	...	...	...
Unio pictorum	...	...	...	...	3	...	...	5	6	7	8	9	...	...	12	13	14
U. tumidus	...	...	...	...	...	...	...	5	6	7	8	9	...	...	...	...	...
Anodonta cygnea	...	...	...	*2*	3	*4*	...	...	6	7	8	9	10	11	12	13	14
A. anatina	...	...	...	2	3	4	...	5	6	7	8	9	...	11	...	13	14
A. minima	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sphaerium rivicola	...	...	...	...	3	...	...	...	6	7	8	9	...	*11*	*12*	13	...
S. corneum	0	*1a*	...	...	3	4	...	5	6	7	8	9	10	11	12	13	14
*S. transversum	...	...	...	...	*3*	...	...	...	6	7	8	...	...	...	...	...	...
S. lacustre	0	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
Pisidium amnicum	...	...	1	2	3	...	...	5	6	7	8	9	10	11	12	13	14
P. casertanum	0	1*a*	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
P. conventus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. personatum	0	1*a*	1	2	3	4	*4a*	5	6	7	8	9	10	11	...	13	14
P. obtusale	0	1*a*	1	2	3	4	...	*5*	6	7	8	9	10	11	...	13	14
P. milium	0	1*a*	1	2	3	4	...	5	6	...	...	9	10	11	12	13	14
P. pseudosphaerium	...	...	...	...	...	...	...	...	6	...	...	...	...	...	...	...	14
P. subtruncatum	0	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
P. supinum	...	...	...	...	...	...	...	...	6	...	...	...	...	...	...	...	...
P. henslowanum	...	...	...	2	3	4	...	5	6	7	8	9	...	11	12	13	14
P. lilljeborgi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. hibernicum	...	...	...	...	3	4	...	...	6	...	...	...	...	...	12	...	14
P. nitidum	0	...	1	2	3	4	...	5	6	7	8	9	10	11	12	13	14
P. pulchellum	...	...	...	...	3	...	...	...	6	...	...	9	10	11	...	13	14
P. moitessierianum	...	...	...	2	...	...	...	...	6	7	8	...	...	...	...	...	...
P. tenuilineatum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
†P. vincentianum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dreissena polymorpha	...	...	...	...	3	...	...	...	6	7	8	...	...	...	...	...	...
Total number of species	70 + *7*	40 + *4*	83 + *10*	83 + *1*	121 + *9*	96 + *5*	41 + *1*	99 + *2*	118 + *9*	110 + *5*	106 + *9*	114 + *8*	95 + *8*	117 + *2*	97 + *4*	119 + *2*	117 + *4*

ENGLAND.

Numerals in small type indicate Holocene or dead shells.

Numerals in italics indicate records requiring confirmation or adventitious introductions.

Thames.										Ouse.								NAME OF SPECIES.
15. Kent East	16. Kent West	17. Surrey	18. Essex South	19. Essex North	20. Herts	21. Middlesex	22. Berks	23. Oxford	24. Bucks	25. Suffolk East	26. Suffolk West	27. Norfolk East	28. Norfolk West	29. Cambridge	30. Bedford	21. Hunts	32. Northampton	
15	*16*	17	...	*19*	*20*	*21*	22	23	...	*25*	...	27	*28*	29	...	...	*32*	Milax gagates
15	*16*	17	18	...	20	21	22	23	24	*25*	26	27	*28*	29	30	*31*	*32*	M. sowerbyi
...	16	17	18	...	20	21	...	...	...	...	...	...	...	...	30	...	...	M. budapestensis
15	16	17	18	...	20	...	...	23	24	...	...	...	...	...	...	...	...	Limax tenellus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	L. maximus
15	...	17	18	...	20	...	22	23	24	...	...	...	...	...	...	...	...	L. cinereoniger
15	16	17	...	...	20	21	22	23	24	25	...	27	...	29	30	31	32	L. flavus
15	16	17	18	*19*	20	...	22	23	24	25	26	27	28	29	30	31	32	L. marginatus
...	...	...	...	...	...	...	...	...	...	...	...	27	...	...	...	...	...	Agriolimax agrestis
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	A. reticulatus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A. caruanae
15	16	17	...	19	20	21	22	23	24	25	26	27	28	29	30	31	32	A. lævis
																		BIVALVIA.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	M. margaritifera
15	16	17	18	19	20	21	22	23	24	25	26	27	...	29	30	31	32	Unio pictorum
15	16	17	18	19	20	21	22	23	24	...	...	*27*	...	29	30	31	32	U. tumidus
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Anodonta cygnea
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	...	32	A. anatina
...	...	17	18	...	...	21	...	23	24	...	...	27	...	...	30	...	...	A. minima
15	16	17	18	19	20	21	22	23	24	*25*	...	*27*	...	...	30	31	32	Sphaerium rivicola
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	S. corneum
...	...	17	*18*	...	...	21	...	23	*24*	...	...	...	...	...	...	...	32	*S. transversum
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	S. lacustre
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Pisidium amnicum
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. casertanum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. conventus
15	16	17	18	19	20	21	22	23	...	25	26	27	*28*	29	30	31	32	P. personatum
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. obtusale
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. milium
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. pseudosphaerium
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. subtruncatum
15	16	17	18	19	20	21	22	23	24	...	...	...	...	29	30	31	32	P. supinum
15	16	17	18	19	20	21	22	23	24	25	26	27	...	29	30	31	32	P. henslowanum
...	...	17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. lilljeborgi
15	...	17	...	19	20	21	22	...	24	25	26	27	...	29	30	31	...	P. hibernicum
15	*16*	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	P. nitidum
15	*16*	17	18	19	20	21	22	*23*	24	25	26	27	28	29	...	31	32	P. pulchellum
15	...	17	...	...	20	21	22	23	24	...	...	27	...	...	30	...	32	P. moitessierianum
...	...	17	18	...	...	...	22	23	24	...	...	...	...	...	...	...	32	P. tenuilineatum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†P. vincentianum
...	...	17	18	...	20	21	22	23	24	25	26	27	...	29	30	31	32	Dreissena polymorpha
122 + 7	117 + 9	128 + 3	102 + 7	105 + 5	122 + 3	113 + 5	120 + 2	123 + 5	118 + 6	118 + 6	102 + 8	120 + 4	101 + 6	106 + 1	114 + 1	95 + 7	116 + 4	*Total number of species.*

	ENGLAND.								WALES.											
	Severn.								South Wales.						North Wales.					
NAME OF SPECIES. Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	33. Gloucester East	34. Gloucester West	35. Monmouth	36. Hereford	37. Worcester	38. Warwick	39. Stafford	40. Salop	41. Glamorgan	42. Brecon	43. Radnor	44. Carmarthen	45. Pembroke	46. Cardigan	47. Montgomery	48. Merioneth	49. Caernarvon	50. Denbigh	51. Flint	52. Anglesey
GASTROPODA.																				
Theodoxus fluviatilis	33	34	35	36	37	38	39	40	41	...	...	...	...	...	...	...	...	...	...	...
Viviparus viviparus	33	34	35	36	37	38	39	40	41	42	...	...	...	...	47	...	...	50	...	...
V. fasciatus	33	34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Valvata cristata	33	34	35	36	37	*38*	39	...	41	42	43	...	45	...	47	...	...	50	...	52
V. macrostoma	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. piscinalis	33	34	35	36	37	38	39	40	41	42	43	...	45	*46*	47	48	49	50	51	52
Pomatias elegans	33	34	35	36	37	38	...	...	41	...	...	44	45	...	...	...	49	50	51	...
Acme fusca	33	...	...	...	...	...	...	...	41	42	43	44	45	*46*	...	48	49	50	51	52
‡Hydrobia ventrosa	...	...	...	...	...	...	...	...	41	...	...	...	...	...	...	...	...	50	...	52
‡H. ulvae	...	...	35	...	...	...	...	...	41	...	...	44	45	46	...	48	49	50	51	52
‡Pseudamnicola confusa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Potamopyrgus jenkinsi	33	34	35	36	37	38	39	40	41	42	...	44	45	46	47	48	49	50	51	52
*Bythinella scholtzi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bithynia tentaculata	33	34	35	36	37	38	39	40	41	42	43	...	...	...	47	...	...	50	...	...
B. leachi	33	34	...	36	...	38	39	40	41	...	...	...	45	...	47	...	...	50	...	...
‡Assiminea grayana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Carychium minimum *agg.*	33	34	35	36	37	38	39	40	...	42	43	44	45	46	47	48	49	...	51	52
C. minimum *seg.*	...	34	...	...	...	38	...	...	41	...	...	...	45	...	...	...	...	50	...	...
C. tridentatum	33	34	...	...	...	...	...	...	41	...	...	...	...	...	...	...	...	50	51	...
‡Leucophytia bidentata	...	34	...	...	...	...	...	...	41	...	...	...	45	...	...	...	...	...	...	...
‡Phytia myosotis	...	34	35	...	...	...	...	...	41	...	...	44	45	...	...	...	49	50	51	...
Lymnaea truncatula	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
L. glabra	...	...	...	...	37	...	39	40	...	*42*	...	...	45	...	47	48	...	...	...	...
L. palustris	33	34	35	36	37	38	39	40	41	42	43	44	45	...	47	...	49	50	51	52
L. stagnalis	33	34	35	36	37	38	39	40	41	42	43	...	*45*	...	47	...	...	50	...	52
L. auricularia	33	34	35	36	37	38	39	40	41	42	...	44	...	...	47	...	...	50	...	52
L. peregra	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
L. glutinosa	33	34	...	...	*37*	38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Aplexa hypnorum	33	34	35	36	37	38	39	40	41	42	...	...	45	...	...	...	49	50	51	52
Physa fontinalis	33	34	35	36	37	38	39	40	41	42	43	44	45	...	47	48	49	50	51	52
*Physa *spp.*	33	34	...	...	...	38	39	40	41	...	...	...	...	...	...	...	...	...	...	*52*
Planorbarius corneus	33	34	35	36	37	38	39	40	41	42	...	...	...	...	47	...	...	50	...	...
*Menetus dilatatus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Planorbis carinatus	33	34	35	36	37	38	39	40	41	42	...	...	...	...	47	...	...	50	51	...
P. planorbis	33	34	35	36	37	38	39	40	41	42	...	44	...	...	47	...	...	...	...	52
P. vorticulus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. vortex	33	34	35	36	37	38	39	40	41	42	...	...	...	...	47	...	...	50	51	52
P. leucostoma	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
P. laevis	...	...	35	*36*	37	38	39	...	*41*	42	43	...	45	...	...	...	49	...	51	52
P. albus	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
P. acronicus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. crista	33	34	35	36	37	38	39	40	41	42	...	...	45	46	47	*48*	49	...	51	52
P. contortus	33	34	35	36	37	38	39	40	41	42	43	...	...	...	47	48	49	50	51	52
Segmentina complanata	33	34	...	36	37	38	39	40	41	42	43	44	45	...	47	...	49	50	51	52
S. nitida	...	...	...	*36*	37	...	...	...	41	...	...	...	...	...	47	...	...	...	...	...
Acroloxus lacustris	33	34	35	36	37	38	39	40	41	42	43	...	45	...	47	...	...	...	...	52
Ancylus fluviatilis	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52

ENGLAND.																			Name of Species Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
Trent.					Mersey.			Humber.					Tyne.			Lakes.			
53. Lincoln South	54. Lincoln North	55. Leicester	56. Nottingham	57. Derby	58. Chester	59. Lancaster South	60. Lancaster West	61. York South-east	62. York North-east	63. York South-west	64. York Mid-west	65. York North-west	66. Durham	67. Northumberland S.	68. Cheviotland	69. Westmorland	70. Cumberland	71. Isle of Man	
																			GASTROPODA.
53	54	55	56	57	58	…	60	61	62	63	64	65	*66*	…	…	69	…	…	Theodoxus fluviatilis
53	54	55	56	57	58	59	*60*	61	62	63	64	…	*66*	…	…	…	…	…	Viviparus viviparus
53	54	55	56	*57*	58	59	*60*	61	62	63	64	…	*66*	…	…	*69*	…	…	V. fasciatus
53	54	*55*	56	57	58	59	60	61	62	63	64	…	66	67	*68*	69	70	…	Valvata cristata
53	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	V. macrostoma
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	V. piscinalis
53	54	*55*	56	…	…	…	60	…	62	…	64	…	…	…	…	69	…	…	Pomatias elegans
…	54	…	56	57	58	…	60	61	62	63	64	…	66	…	68	69	*70*	71	Acme fusca
53	54	…	…	…	…	…	…	61	…	…	…	…	66	*67*	…	…	…	…	‡Hydrobia ventrosa
53	54	…	…	…	58	59	60	61	…	…	…	…	66	67	68	69	70	…	‡H. ulvae
…	54	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	‡Pseudamnicola confusa
53	54	55	56	…	58	59	60	61	62	63	64	65	66	67	…	69	70	…	Potamopyrgus jenkinsi
…	…	…	…	…	58	59	…	…	…	…	…	…	…	…	…	…	…	…	*Bythinella scholtzi
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	…	Bithynia tentaculata
53	54	55	56	57	…	59	…	61	62	63	64	…	*66*	…	…	…	…	…	B. leachi
…	54	…	…	…	…	…	…	61	…	…	…	…	…	…	…	…	…	…	‡Assiminea grayana
53	54	55	…	…	…	59	60	61	62	63	64	65	66	67	68	…	70	71	Carychium minimum
…	…	…	56	57	58	…	…	61	…	…	…	…	66	…	…	69	…	…	C. minimum *seg.* [*agg.*
…	54	55	56	57	58	59	60	61	…	…	64	…	66	…	…	69	…	…	C. tridentatum
…	…	…	…	…	…	…	…	…	…	…	…	…	…	*67*	…	…	…	71	‡Leucophytia bidentata
53	54	…	…	…	58	59	…	61	…	…	…	…	*66*	…	*68*	…	…	71	‡Phytia myosotis
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Lymnaea truncatula
53	54	…	*56*	*57*	58	59	*60*	61	62	63	64	65	66	67	…	69	70	…	L. glabra
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	L. palustris
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	…	…	L. stagnalis
53	54	55	56	57	58	59	60	61	62	63	64	…	66	67	68	69	70	…	L. auricularia
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	L. peregra
…	54	…	*56*	*57*	…	…	…	61	62	…	…	…	…	…	…	69	*70*	…	L. glutinosa
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	…	69	70	71	Aplexa hypnorum
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Physa fontinalis
…	…	…	…	…	58	59	…	…	…	63	…	…	…	67	…	…	…	…	*Physa _spp._
53	54	55	56	57	58	59	…	61	62	63	64	65	66	67	…	…	…	…	Planorbarius corneus
…	…	…	…	…	58	59	…	…	…	63	…	…	…	…	…	…	…	…	*Menetus dilatatus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	…	69	70	…	Planorbis carinatus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	*68*	69	70	…	P. planorbis
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	P. vorticulus
53	54	55	56	57	58	59	60	61	62	63	64	…	66	…	…	69	70	71	P. vortex
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	P. leucostoma
53	…	55	56	57	…	59	…	61	62	63	64	65	66	67	68	…	70	…	P. laevis
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	P. albus
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…		P. acronicus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	*69*	70	71	P. crista
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	P. contortus
53	54	55	56	*57*	58	59	60	61	62	63	64	…	66	67	…	69	70	…	Segmentina complanata
53	54	*55*	56	…	…	59	60	61	…	63	64	…	*66*	…	…	…	*70*	…	S. nitida
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	*68*	69	70	…	Acroloxus lacustris
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Ancylus fluviatilis

NAME OF SPECIES.	ENGLAND.								WALES.											
	Severn.								South Wales.						North Wales.					
Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	33. Gloucester East	34. Gloucester West	35. Monmouth	36. Hereford	37. Worcester	38. Warwick	39. Stafford	40. Salop	41. Glamorgan	42. Brecon	43. Radnor	44. Carmarthen	45. Pembroke	46. Cardigan	47. Montgomery	48. Merioneth	49. Caernarvon	50. Denbigh	51. Flint	52. Anglesey
Catinella arenaria	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Succinea oblonga	...	...	...	...	...	...	...	...	*41*	...	...	...	...	...	...	*48*	...	...	...	...
S. putris	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
S. pfeifferi	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
S. elegans	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Azeca goodalli	33	34	35	36	37	38	39	40	41	42	43	...	...	...	47	48	...	50	51	...
Cochlicopa lubrica	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Pyramidula rupestris	33	34	35	36	37	38	39	...	41	42	...	44	45	46	...	48	49	50	51	52
Columella edentula	33	34	35	36	37	38	39	40	41	...	...	...	45	46	47	48	49	50	51	52
Truncatellina cylindrica	...	*34*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
T. cylindrica britannica	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Vertigo pusilla	...	34	...	36	37	38	39	...	41	...	...	...	...	...	...	48	49	...	51	...
V. antivertigo	33	34	...	36	*37*	...	39	*40*	41	...	43	...	45	46	...	48	49	50	51	52
V. substriata	...	...	...	36	...	...	39	*40*	41	...	...	...	45	46	...	48	49	50	51	52
V. pygmaea	33	34	35	36	37	38	39	*40*	41	42	43	*44*	45	46	47	48	49	50	51	52
V. genesii	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
†V. parcedentata	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. moulinsiana	...	34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51	...
V. lilljeborgi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. alpestris	...	...	...	...	...	...	...	...	41	...	...	...	...	...	...	48	...	...	...	...
V. angustior	...	*34*	...	...	...	...	...	...	41	...	...	...	*45*	...	...	...	...	...	51	...
Pupilla muscorum	33	34	...	*36*	37	*38*	39	40	41	...	...	...	45	46	...	48	49	50	51	52
Lauria cylindracea	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
L. anglica	33	*34*	...	36	37	...	...	...	41	...	...	...	45	...	...	48	49	50	51	52
Abida secale	33	34	35	36	*37*	...	...	40	41	...	...	...	...	...	...	...	...	...	...	...
Acanthinula aculeata	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
A. lamellata	33	...	...	...	...	...	39	...	...	...	...	...	...	46	...	*48*	...	...	51	...
Vallonia costata	33	34	...	36	37	38	39	40	41	42	43	...	45	...	...	48	49	50	51	52
V. pulchella *agg*.	...	...	35	...	...	38	39	40	...	42	43	44	...	46	47	48	...	...	51	...
V. pulchella *seg*.	33	34	35	36	37	...	...	...	41	...	43	...	45	46	47	48	49	50	...	52
V. excentrica	33	34	35	36	37	38	39	40	41	...	...	44	45	46	47	...	49	50	51	52
Ena montana	33	34	...	...	37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
E. obscura	33	34	35	36	37	38	39	40	41	42	43	44	45	...	47	...	49	50	51	52
Marpessa laminata	33	34	35	36	37	38	39	40	41	42	...	...	...	...	...	...	...	50	51	...
Clausilia bidentata	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
C. dubia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C. rolphi	33	...	35	...	37	*38*	...	40	...	...	...	...	...	...	...	...	...	...	...	...
Laciniaria biplicata	*33*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Balea perversa	33	34	35	36	*37*	38	39	40	41	42	43	...	45	46	...	48	49	50	51	52
Cecilioides acicula	33	34	...	36	37	38	39	...	41	*42*	*43*	44	45	...	...	...	...	50	...	52
Testacella maugei	33	34	35	36	37	38	...	...	41	...	...	...	45	...	...	...	...	...	...	...
T. haliotidea	...	34	35	...	37	38	39	...	...	...	43	...	...	...	...	...	...	...	...	...
T. scutulum	...	...	...	...	37	38	39	...	41	...	...	...	...	...	...	...	49	...	...	...
Fruticicola fruticum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Helicodonta obvoluta	33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Helicigona lapicida	33	34	35	36	37	38	39	40	41	42	43	...	...	...	47	...	...	50	...	...
Arianta arbustorum	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52

ENGLAND.																			
Trent.					Mersey.			Humber.					Tyne.			Lakes.			Name of Species.
53. Lincoln South	54. Lincoln North	55. Leicester	56. Nottingham	57. Derby	58. Chester	59. Lancaster South	60. Lancaster West	61. York South-east	62. York North-east	63. York South-west	64. York Mid-west	65. York North-west	66. Durham	67. Northumberland S.	68. Cheviotland	69. Westmorland	70. Cumberland	71. Isle of Man	Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Catinella arenaria
...	...	...	...	...	...	...	...	...	*62*	...	...	...	...	...	...	69	...	...	Succinea oblonga
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	S. putris
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	S. pfeifferi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	S. elegans
53	54	*55*	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	...	Azeca goodalli
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Cochlicopa lubrica
53	*54*	*55*	*56*	57	*58*	59	60	*61*	62	63	64	65	66	...	...	69	70	71	Pyramidula rupestris
53	54	*55*	56	57	58	59	60	...	62	63	64	...	66	67	68	69	70	71	Columella edentula
...	54	...	...	...	58	59	...	*61*	*62*	63	...	...	*66*	...	...	...	...	...	Truncatellina cylindrica
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T. cylindrica britannica
...	...	55	*56*	57	*58*	59	60	61	62	63	64	...	66	67	68	69	70	...	Vertigo pusilla
...	54	...	56	57	58	59	60	61	62	63	64	...	66	...	68	69	70	71	V. antivertigo
53	54	*55*	*56*	57	58	59	60	61	62	63	64	...	66	67	...	69	70	71	V. substriata
53	54	*55*	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	V. pygmaea
...	54	...	...	...	...	...	...	...	...	...	...	65	...	...	...	...	...	...	V. genesii
...	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†V. parcedentata
...	54	...	56	57	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. moulinsiana
...	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	69	70	...	V. lilljeborgi
...	54	...	56	...	...	...	60	...	...	63	64	...	...	67	...	69	70	...	V. alpestris
...	54	...	56	57	58	...	...	61	...	63	*64*	...	*66*	...	...	...	...	...	V. angustior
53	54	*55*	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Pupilla muscorum
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Lauria cylindracea
...	54	...	56	*57*	58	59	...	61	62	63	64	*65*	66	67	68	69	70	71	L. anglica
53	54	...	*56*	57	...	...	...	...	...	...	64	65	...	...	...	69	70	...	Abida secale
53	54	55	56	57	58	59	60	...	62	63	64	65	66	67	68	69	70	...	Acanthinula aculeata
...	...	...	56	57	58	...	...	61	62	63	64	...	66	67	68	69	70	...	A. lamellata
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Vallonia costata
53	...	...	...	...	58	...	...	61	62	...	64	65	...	...	...	69	...	...	V. pulchella *agg.*
53	54	55	56	57	58	59	60	...	...	63	...	...	66	67	68	...	70	71	V. pulchella *seg.*
53	54	55	56	57	58	59	60	...	...	63	64	...	66	67	68	69	70	71	V. excentrica
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Ena montana
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	...	E. obscura
53	54	*55*	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	...	Marpessa laminata
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Clausilia bidentata
...	...	...	...	...	...	...	60	...	*62*	63	64	65	66	67	*68*	69	70	...	C. dubia
53	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	C. rolphi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Laciniaria biplicata
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Balea perversa
53	54	55	56	57	58	59	60	...	62	63	64	*65*	66	67	*68*	69	...	71	Cecilioides acicula
...	...	...	...	...	58	...	...	...	...	...	...	...	...	...	...	...	...	...	Testacella maugei
...	54	...	56	57	58	59	...	61	62	63	...	...	66	...	...	...	...	...	T. haliotidea
...	54	55	56	57	58	59	...	61	62	63	64	...	66	67	...	...	...	...	T. scutulum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Fruticicola fruticum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Helicodonta obvoluta
53	54	55	56	57	...	...	...	61	62	63	64	65	*66*	...	...	...	...	...	Helicigona lapicida
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	...	Arianta arbustorum

NAME OF SPECIES.	ENGLAND.								WALES.											
	Severn.								South Wales.						North Wales.					
Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	33. Gloucester East	34. Gloucester West	35. Monmouth	36. Hereford	37. Worcester	38. Warwick	39. Stafford	40. Salop	41. Glamorgan	42. Brecon	43. Radnor	44. Carmarthen	45. Pembroke	46. Cardigan	47. Montgomery	48. Merioneth	49. Caernarvon	50. Denbigh	51. Flint	52. Anglesey
Theba pisana	*33*	...	...	...	...	...	...	...	41	...	...	...	45	...	...	...	...	...	...	...
Helix hortensis	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
H. nemoralis	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
H. aspersa	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
H. pomatia	33	34	...	36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*Hygromia limbata	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*H. cinctella	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H. subrufescens	*33*	34	35	36	37	*38*	39	*40*	41	42	*43*	44	45	46	47	48	49	50	51	...
H. striolata	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
H. hispida	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
H. liberta	...	34	...	...	...	38	39	40	...	...	...	...	...	...	...	...	...	...	...	...
H. subvirescens	...	...	...	...	...	...	...	...	...	...	...	...	45	...	...	...	...	...	...	...
Monacha granulata	33	34	*35*	...	37	...	*39*	*40*	41	...	...	44	45	...	...	48	49	50	51	52
M. cartusiana	...	...	...	...	...	...	...	...	*41*	...	...	...	...	...	...	...	...	...	...	...
M. cantiana	33	34	35	36	37	38	39	40	41	...	...	...	...	...	...	...	...	...	...	...
Helicella caperata	33	34	35	36	37	*38*	39	40	41	42	43	44	45	46	47	48	49	50	51	52
H. gigaxi	33	34	...	36	*37*	38	39	40	41	...	...	...	*45*	...	...	48	...	50	51	...
H. virgata	33	34	35	36	37	38	39	...	41	...	...	44	45	46	...	48	49	50	51	52
H. itala	33	34	...	36	37	38	39	40	41	...	...	44	45	46	...	*48*	49	50	51	52
*H. elegans	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cochlicella acuta	...	34	...	...	...	...	...	...	41	...	...	44	45	46	...	*48*	49	50	51	52
Punctum pygmaeum	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
†Discus ruderatus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
D. rotundatus	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Geomalacus maculosus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Arion intermedius	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
A. circumscriptus	33	34	35	36	37	38	39	40	41	42	43	44	45	...	47	48	49	50	51	52
A. hortensis	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
A. subfuscus	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	...	52
A. ater *agg*.	33	34	35	36	37	38	39	40	...	42	43	44	45	46	47	48	49	50	51	52
A. ater *seg*..	...	...	...	...	...	...	...	...	41	42	...	...	45	...	...	...	49	...	...	...
A. rufus	...	...	...	...	...	...	...	...	41	...	...	...	...	...	...	...	...	...	...	...
Euconulus fulvus	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Vitrea crystallina	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Oxychilus draparnaldi	...	34	35	*36*	...	...	...	...	41	...	43	44	45	46	...	*48*	49	50	...	52
O. cellarius	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
O. alliarius	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
O. helveticus	...	34	35	*36*	37	38	39	40	41	42	43	44	*45*	...	47	48	49	50	51	52
†Retinella petronella	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
R. radiatula	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
R. pura	33	34	35	36	37	38	39	40	41	42	43	44	...	46	47	48	49	50	51	52
R. nitidula	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Zonitoides excavatus	33	...	35	...	...	38	39	...	41	42	...	44	45	46	47	48	49	...	...	...
Z. nitidus	33	34	35	36	37	38	39	40	41	42	...	44	45	46	47	48	49	50	51	52
Vitrina pellucida	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
V. major	33	...	35	36	...	...	...	...	...	42	...	...	...	...	...	...	...	...	...	...
*V. pyrenaica	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

ENGLAND.

Trent.					Mersey.			Humber.					Tyne.			Lakes.			NAME OF SPECIES.
53. Lincoln South	54. Lincoln North	55. Leicester	56. Nottingham	57. Derby	58. Chester	59. Lancaster South	60. Lancaster West	61. York South-east	62. York North-east	63. York South-west	64. York Mid-west	65. York North-west	66. Durham	67. Northumberland S.	68. Cheviotland	69. Westmorland	70. Cumberland	71. Isle of Man	Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
...	...	...	...	...	...	...	...	...	*62*	...	...	...	...	...	...	...	...	...	Theba pisana
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Helix hortensis
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	H. nemoralis
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	H. aspersa
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. pomatia
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Hygromia limbata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*H. cinctella
53	...	...	*56*	57	58	59	*60*	...	62	63	64	...	66	67	68	69	70	71	H. subrufescens
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	H. striolata
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	H. hispida
...	54	55	56	...	...	...	60	61	...	...	64	...	...	...	...	69	...	...	H. liberta
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. subvirescens
53	...	*55*	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	*71*	Monacha granulata
...	...	...	...	...	...	...	...	*61*	...	...	...	...	...	*67*	...	...	...	...	M. cartusiana
53	54	55	56	...	...	...	...	61	62	63	64	65	66	67	...	...	...	...	M. cantiana
53	54	55	56	*57*	58	59	60	61	62	*63*	*64*	*65*	66	67	68	69	70	71	Helicella caperata
...	54	55	...	...	58	59	...	61	62	63	...	...	66	67	68	...	...	...	H. gigaxi
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	H. virgata
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	*68*	69	70	71	H. itala
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*70*	...	*H. elegans
...	...	...	...	...	58	...	60	...	...	*63*	...	...	...	...	...	...	*70*	71	Cochlicella acuta
53	54	*55*	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Punctum pygmaeum
...	54	...	56	57	...	...	60	...	...	...	...	...	...	...	...	...	...	...	†Discus ruderatus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	D. rotundatus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Geomalacus maculosus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Arion intermedius
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	A. circumscriptus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	A. hortensis
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	A. subfuscus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	A. ater *agg.*
...	...	...	...	...	58	...	...	...	...	...	...	...	...	...	...	...	...	...	A. ater *seg.*
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A. rufus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Euconulus fulvus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Vitrea crystallina
...	54	...	...	*57*	58	59	60	61	*62*	63	...	65	66	67	...	69	70	71	Oxychilus draparnaldi
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	O. cellarius
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	O. alliarius
53	54	55	56	57	58	59	60	...	62	63	64	65	66	67	68	69	70	...	O. helveticus
...	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†Retinella petronella
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	R. radiatula
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	R. pura
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	R. nitidula
...	54	*55*	*56*	57	58	59	60	*61*	62	63	64	*65*	66	67	*68*	69	70	...	Zonitoides excavatus
53	54	55	56	57	58	59	60	61	62	63	64	...	*66*	67	68	69	70	71	Z. nitidus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	Vitrina pellucida
...	...	...	...	...	...	...	...	...	...	...	...	...	...	*67*	...	...	...	...	V. major
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*V. pyrenaica

NAME OF SPECIES.	ENGLAND.								WALES.											
	Severn.								South Wales.						North Wales.					
Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	33. Gloucester East	34. Gloucester West	35. Monmouth	36. Hereford	37. Worcester	38. Warwick	39. Stafford	40. Salop	41. Glamorgan	42. Brecon	43. Radnor	44. Carmarthen	45. Pembroke	46. Cardigan	47. Montgomery	48. Merioneth	49. Caernarvon	50. Denbigh	51. Flint	52. Anglesey
Milax gagates . .	...	*34*	*35*	*36*	*37*	*38*	39	*40*	41	*42*	...	...	45	*46*	47	...	*49*	...	*51*	*52*
M. sowerbyi . .	33	34	*35*	36	37	*38*	39	*40*	41	42	...	*44*	45	*46*	47	...	*49*	*50*	*51*	*52*
M. budapestensis .	33	34	35	36	37	...	39	40	41	42	...	...	45	...	...	...	...	50	...	...
Limax tenellus . .	33	34	35	36	37	...	39	40	...	42	...	...	...	...	47	...	...	...	...	...
L. maximus . .	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
L. cinereoniger . .	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	...	...
L. flavus . . .	33	34	35	36	37	38	39	40	41	42	...	44	45	...	47	48	49	50	51	...
L. marginatus . .	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	...	52
Agriolimax agrestis .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. reticulatus . .	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
A. caruanae . .	...	...	...	...	...	...	...	...	41	...	...	...	...	...	...	...	...	50	...	...
A. laevis . . .	33	34	35	36	37	*38*	39	40	41	42	43	44	45	46	47	48	49	50	51	52
BIVALVIA.																				
M. margaritifera .	...	34	35	36	37	...	...	*40*	41	...	*43*	44	45	46	...	48	49	50	...	...
Unio pictorum . .	33	34	...	36	37	38	39	40	...	42	...	...	...	...	47	...	...	...	...	...
U. timidus . .	33	34	...	36	37	38	39	40	...	...	...	...	...	...	47	...	...	50	...	...
Anodonta cygnea .	33	34	35	36	37	38	39	40	41	42	...	...	45	...	47	...	...	...	...	52
A. anatina . . .	33	34	35	36	37	38	39	40	41	42	43	...	45	...	47	...	49	...	...	52
A. minima . .	...	34	...	36	37	38	39	40	...	...	...	...	...	...	...	...	...	...	...	...
Sphaerium rivicola .	33	34	...	36	37	38	39	40	...	42	...	...	...	...	47	...	...	...	...	...
S. corneum . .	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
*S. transversum . .	33	34	...	...	37	38	39	40	...	...	...	...	...	...	47	...	...	...	...	...
S. lacustre . .	33	34	...	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Pisidium amnicum .	33	34	35	36	37	38	39	40	41	42	...	...	45	...	47	...	...	50	...	...
P. casertanum . .	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
P. conventus . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	49	...	...	...
P. personatum . .	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
P. obtusale . .	33	34	35	36	37	38	39	40	41	42	43	*44*	45	46	47	48	49	50	51	52
P. milium . .	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
P. pseudosphaerium .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. subtruncatum .	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
P. supinum . .	...	34	...	36	37	38	39	40	...	...	...	...	...	...	...	...	...	...	...	...
P. henslowanum .	33	34	35	36	37	38	39	40	41	42	...	...	...	...	47	...	...	50	...	52
P. lilljeborgi . .	...	...	...	...	...	...	...	...	41	...	...	...	...	...	47	48	49	50	...	52
P. hibernicum . .	33	34	35	...	37	38	39	40	41	42	43	...	45	46	47	48	49	50	...	52
P. nitidum . .	33	34	35	36	37	38	39	40	41	42	43	...	45	46	47	48	49	50	51	52
P. pulchellum . .	...	34	...	36	...	38	...	40	...	42	43	...	...	...	47	...	...	50	...	52
P. moitessierianum .	...	...	...	36	37	38	...	40	...	...	...	...	...	...	47	...	...	...	...	...
P. tenuilineatum .	...	...	...	...	...	...	...	40	...	...	...	...	...	...	...	...	...	...	...	...
†P. vincentianum .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dreissena polymorpha .	33	34	...	36	37	38	39	40	...	...	...	...	...	...	...	...	...	...	...	...
Total number of species .	114 + *3*	120 + *3*	101 + *1*	109 + *5*	113 + *5*	108 + *6*	113 + *1*	104 + *6*	119 + *2*	94 + *2*	72 + *3*	71 + *2*	96 + *4*	70 + *2*	94	79 + *5*	90	105	81	92 + *1*

ENGLAND.																			
Trent.					***Mersey.***			**Humber.**					**Tyne.**			**Lakes.**			NAME OF SPECIES.
53. Lincoln South	54. Lincoln North	55. Leicester	56. Nottingham	57. Derby	58. Chester	59. Lancaster South	60. Lancaster West	61. York South-east	62. York North-east	63. York South-west	64. York Mid-west	65. York North-west	66. Durham	67. Northumberland S.	68. Cheviotland	69. Westmorland	70. Cumberland	71. Isle of Man	Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
53	54	*55*	56	*57*	*58*	*59*	*60*	*61*	62	*63*	64	...	66	67	*68*	...	*70*	71	Milax gagates
53	*54*	55	56	...	*58*	*59*	*60*	*61*	*62*	63	*64*	...	66	67	...	...	...	71	M. sowerbyi
...	...	...	...	...	58	59	...	...	...	...	64	...	66	67	...	...	...	71	M. budapestensis
...	...	...	...	...	...	...	...	...	...	*63*	...	65	66	67	...	...	...	...	Limax tenellus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	L. maximus
53	54	...	...	57	58	...	...	61	62	63	64	65	66	67	68	69	70	71	L. cinereoniger
53	54	55	56	...	58	59	60	61	62	63	64	65	66	67	...	69	70	71	L. flavus
53	54	...	56	57	58	59	*60*	61	62	63	64	65	66	67	68	69	70	71	L. marginatus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Agriolimax agrestis
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	A. reticulatus
...	...	...	...	...	58	...	...	...	...	...	64	...	66	...	...	...	...	...	A. caruanae
53	54	55	56	...	58	59	60	61	62	63	64	65	66	67	68	69	70	71	A. laevis
																			BIVALVIA.
...	...	...	...	...	...	...	60	...	62	...	...	...	*66*	67	*68*	69	70	71	M. margaritifera
53	54	55	56	57	58	59	...	...	62	63	64	*65*	...	...	68	*69*	*70*	...	Unio pictorum
53	54	55	56	57	58	59	60	61	62	63	64	...	...	...	...	...	...	...	U. tumidus
53	54	55	56	57	58	59	60	61	62	63	64	65	66	*67*	*68*	*69*	70	...	Anodonta cygnea
...	54	55	56	*57*	58	59	60	61	62	63	64	65	66	67	68	...	70	71	A. anatina
...	...	...	56	...	58	...	...	61	...	63	...	...	...	...	...	...	...	...	A. minima
53	54	55	56	57	58	59	...	61	62	63	64	...	*66*	*67*	...	...	...	...	Sphaerium rivicola
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	S. corneum
...	...	...	*56*	*57*	58	59	...	...	62	63	64	...	...	...	...	...	...	...	*S. transversum
53	54	55	56	57	58	59	60	61	62	63	64	...	66	67	68	69	70	...	S. lacustre
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	...	Pisidium amnicum
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	P. casertanum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	69	70	...	P. conventus
...	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	P. personatum
53	54	55	56	*57*	58	59	60	61	62	63	64	*65*	66	67	68	69	70	*71*	P. obtusale
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	P. milium
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. pseudosphaerium
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	P. subtruncatum
53	...	55	56	...	58	59	...	61	62	63	64	65	...	...	...	...	*70*	...	P. supinum
53	54	55	56	*57*	58	59	60	61	62	63	64	65	66	67	68	...	...	...	P. henslowanum
...	...	...	...	...	...	...	60	...	62	...	64	...	...	67	...	69	70	...	P. lilljeborgi
53	54	...	56	...	58	59	60	61	62	63	64	...	66	*67*	...	69	70	71	P. hibernicum
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	P. nitidum
53	54	...	56	...	59	*59*	60	...	62	...	...	...	66	67	68	69	70	...	P. pulchellum
...	...	...	...	...	58	...	...	...	...	...	64	...	...	...	...	...	...	...	P. moitessierianum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. tenuilineatum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†P. vincentianum
53	54	55	56	57	58	59	60	...	62	63	64	...	...	...	*68*	*69*	...	...	Dreissena polymorpha
108 + 3	119 + *1*	89 + *13*	106 + 8	100 + *10*	120 + 2	116 + *1*	105 + 5	108 + 3	119 + 4	121 + 2	120 + *1*	86 + 5	111 + *11*	105 + 8	84 + *11*	106 + 5	103 + *7*	78 + 2	*Total number of species*

NAME OF SPECIES.	SCOTLAND.																			
	W. Lowlands.						**East Lowlands.**							**East High**						
Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	72. Dumfries	73. Kirkcudbright	74. Wigtown	75. Ayr	76. Renfrew	77. Lanark	78. Peebles	79. Selkirk	80. Roxburgh	81. Berwick	82. Haddington	83. Edinburgh	84. Linlithgow	85. Fife	86. Stirling	87. Perth West	88. Perth Mid	89. Perth East	90. Forfar	91. Kincardine
GASTROPODA.																				
Theodoxus fluviatilis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Viviparus viviparus	...	...	...	...	...	...	...	...	...	...	...	*83*	...	...	...	...	...	...	...	...
V. fasciatus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Valvata cristata	72	73	...	75	76	77	...	79	80	81	82	83	84	85	86	87	88	...	90	...
V. macrostoma	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. piscinalis	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	...
Pomatias elegans	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Acme fusca	...	73	...	75	76	...	...	...	...	...	...	83	...	85	...	...	...	...	...	...
‡Hydrobia ventrosa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
‡H. ulvae	...	73	...	75	...	...	...	...	...	...	82	83	84	85	...	...	...	...	...	...
‡Pseudamnicola confusa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Potamopyrgus jenkinsi	72	...	...	...	76	...	...	...	80	...	...	83	84	85	...	...	88	89	90	91
*Bythinella scholtzi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	86	...	...	...	...	...
Bithynia tentaculata	...	73	74	75	76	77	78	...	...	...	82	83	84	...	86	...	...	...	...	...
B. leachi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*86*	...	...	...	...	...
‡Assiminea grayana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Carychium minimum	...	...	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
C. minimum *seg.* [*agg.*	72	73	...	...	...	...	...	...	...	...	...	...	...	85	...	...	...	...	...	...
C. tridentatum	72	73	...	...	...	...	...	...	...	...	...	...	...	85	...	...	...	...	...	...
‡Leucophytia bidentata	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
‡Phytia myosotis	72	73	...	...	...	...	...	...	...	...	82	83	...	...	...	...	...	...	...	...
Lymnaea truncatula	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
L. glabra	...	...	...	...	...	77	...	...	...	...	...	83	...	...	86	87	...	89	...	...
L. palustris	72	73	74	75	76	77	78	79	80	...	82	83	84	85	86	87	88	89	90	...
L. stagnalis	...	...	...	...	...	77	...	...	80	*81*	82	83	84	...	...	...	...	...	...	...
L. auricularia	72	73	...	...	76	77	...	...	80	81	82	83	...	85	...	87	88	...	...	...
L. peregra	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
L. glutinosa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Aplexa hypnorum	...	...	...	...	...	...	...	...	...	81	82	*83*	...	85	86	87	88	89	...	...
Physa fontinalis	72	73	74	...	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	...
*Physa *spp.*	...	...	...	...	...	77	...	...	...	...	...	...	...	...	...	...	...	...	90	...
Planorbarius corneus	...	...	...	...	...	*77*	...	...	...	...	...	*83*	...	...	...	...	...	...	...	...
Menetus dilatatus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Planorbis carinatus	...	73	...	...	76	...	...	...	...	...	...	83	...	...	...	...	...	...	...	...
P. planorbis	72	73	...	...	76	...	...	79	...	...	82	83	...	85	...	...	...	...	...	...
P. vorticulus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. vortex	...	73	...	...	...	...	...	...	...	...	...	...	...	...	86	...	...	...	90	...
P. leucostoma	72	73	...	75	76	77	78	...	...	81	82	83	84	85	86	87	*88*	89	90	...
P. laevis	72	...	...	...	76	...	...	...	80	81	82	83	...	85	86	87	...	...	90	...
P. albus	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	...
P. acronicus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. crista	72	73	...	...	76	77	78	79	80	81	82	83	84	85	...	87	88	89	90	...
P. contortus	72	73	74	75	76	77	78	79	80	81	82	83	*84*	85	86	87	88	89	90	...
Segmentina complanata	72	73	...	...	76	77	...	79	80	81	82	83	84	85	86	87	88	*89*	90	...
S. nitida	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Acroloxus lacustris	72	73	*74*	...	...	77	...	79	...	81	82	83	84	85	86	87	88	89	90	...
Ancylus fluviatilis	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91

SCOTLAND.																					NAME OF SPECIES.
lands.					West Highlands.							N. Highlands.						Isles.			
92. Aberdeen South	93. Aberdeen Nth.	94. Banff	95. Elgin	96. Easterness	97. Westerness	98. Main Argyll	99. Dunbarton	100. Clyde Isles	101. Kintyre	102. South Ebudes	103. Mid Ebudes	104. North Ebudes	105. Ross West	106. Ross East	107. Sutherland East	108. Sutherland W.	109. Caithness	110. Outer Hebrides	111. Orkney	112. Zetland	Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
																					GASTROPODA.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11	...	Theodoxus fluviatilis
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Viviparus viviparus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. fasciatus
...	...	...	...	...	...	...	...	...	...	...	...	...	05	06	...	...	...	...	11	...	Valvata cristata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. macrostoma
92	...	...	...	96	...	98	99	...	01	...	03	...	...	...	...	08	09	...	...	...	V. piscinalis
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Pomatias elegans
...	...	...	...	...	...	...	...	00	...	...	...	04	05	...	...	...	...	...	...	...	Acme fusca
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10	...	...	‡Hydrobia ventrosa
...	...	...	...	96	...	98	99	00	01	...	03	04	05	06	07	...	...	10	11	12	‡H. ulvae
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	‡Pseudamnicola confusa
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	09	10	11	...	Potamopyrgus jenkinsi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Bythinella scholtzi
...	...	...	...	...	...	...	99	00	...	...	...	...	...	...	...	...	...	...	...	...	Bithynia tentaculata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	B. leachi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	‡Assiminea grayana
92	93	94	95	96	97	98	99	00	01	...	03	04	05	06	07	08	...	10	11	12	Carychium minimum
...	...	...	...	...	...	...	...	...	...	...	...	04	...	...	...	...	...	...	...	...	C. minimum *seg.* [*agg.*
...	...	...	...	...	...	...	...	...	...	...	...	...	...	06	...	...	...	...	...	...	C. tridentatum
...	...	...	...	...	...	...	...	*00*	...	...	...	...	...	...	...	...	...	...	...	...	‡Leucophytia bidentata
...	...	...	...	...	...	...	...	...	...	...	03	...	...	06	...	...	...	...	...	...	‡Phytia myosotis
92	93	94	95	96	97	98	99	00	01	...	03	04	05	06	07	08	09	10	11	12	Lymnaea truncatula
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	L. glabra
92	93	...	95	96	...	98	99	00	01	...	...	...	...	06	...	...	09	10	...	...	L. palustris
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	L. stagnalis
...	...	94	95	...	...	...	99	...	...	...	...	...	...	...	...	...	...	...	...	...	L. auricularia
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	L. peregra
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	L. glutinosa
...	...	...	*95*	...	...	...	...	...	...	...	03	...	...	...	...	...	...	10	...	...	Aplexa hypnorum
92	...	...	...	...	...	98	99	00	...	...	...	...	...	...	...	...	...	...	...	...	Physa fontinalis
92	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Physa *spp.*
...	...	...	...	...	...	*98*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Planorbarius corneus
...	...	...	...	...	...	...	...	...	...	...	...	04	...	...	...	...	...	...	...	...	Menetus dilatatus
...	...	...	...	...	...	...	...	00	...	...	...	...	...	...	...	...	...	...	...	...	Planorbis carinatus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. planorbis
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. vorticulus
...	...	...	...	...	...	...	...	...	...	...	03	...	...	...	...	...	09	...	...	...	P. vortex
92	93	*94*	95	96	...	*98*	...	00	...	02	03	...	...	06	07	08	09	10	11	...	P. leucostoma
...	...	*94*	95	...	...	98	...	00	...	...	03	...	...	...	...	08	09	10	11	12	P. laevis
92	...	94	...	...	...	98	99	00	01	...	03	04	...	...	07	...	...	...	...	...	P. albus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. acronicus
92	93	94	95	96	...	98	...	00	01	...	03	04	05	...	07	08	09	10	11	12	P. crista
92	...	94	95	96	...	98	99	00	01	...	...	...	05	06	...	*08*	09	10	11	12	P. contortus
...	...	...	95	...	...	...	...	...	...	...	...	...	...	06	...	...	...	...	...	...	Segmentina complanata
...	...	...	*95*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	S. nitida
92	93	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Acroloxus lacustris
92	...	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	*12*	Ancylus fluviatilis

NAME OF SPECIES.	SCOTLAND.																				
	W. Lowlands.						East Lowlands.							East High							
Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	72. Dumfries	73. Kirkcudbright	74. Wigtown	75. Ayr	76. Renfrew	77. Lanark	78. Peebles	79. Selkirk	80. Roxburgh	81. Berwick	82. Haddington	83. Edinburgh	84. Linlithgow	85. Fife	86. Stirling	87. Perth West	88. Perth Mid	89. Perth East	90. Forfar	91. Kincardine
Catinella arenaria	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Succinea oblonga	...	...	...	*75*	...	...	...	...	...	*81*	82	83	84	...	86	87	...	...	...	...
S. putris	72	73	*74*	*75*	*76*	77	78	79	*80*	*81*	*82*	*83*	*84*	*85*	*86*	*87*	*88*	*89*	*90*	*91*
S. pfeifferi	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
S. elegans	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Azeca goodalli	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	87	...	...	...	...
Cochlicopa lubrica	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
Pyramidula rupestris	...	...	...	...	...	77	...	...	...	...	...	83	...	...	...	...	88	89	...	...
Columella edentula	72	73	74	75	76	...	78	79	80	81	82	83	84	85	86	87	88	89	90	91
Truncatellina cylindrica	...	...	...	...	...	...	...	...	...	...	*82*	83	...	*85*	...	...	...	89	...	...
T. cylindrica britannica	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Vertigo pusilla	72	73	...	75	...	77	...	...	...	...	...	...	...	85	...	87	...	...	...	91
V. antivertigo	72	73	74	*75*	*76*	...	78	79	80	81	82	83	...	85	86	87	88	89	...	...
V. substriata	72	73	74	75	...	77	78	79	80	81	...	83	...	85	86	87	88	89	...	91
V. pygmaea	72	73	74	75	76	77	78	79	...	81	82	83	84	85	86	87	88	89	90	91
V. genesii	...	...	...	...	...	...	...	...	...	...	...	...	...	85	...	...	...	...	...	...
†V. parcedentata	...	...	...	...	...	...	...	...	...	...	...	...	...	85	...	...	...	...	...	...
V. moulinsiana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. lilljeborgi	72	73	74	75	...	77	78	...	80	...	...	...	...	...	...	87	88	89	...	...
V. alpestris	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. angustior	...	...	...	...	...	...	...	...	...	...	...	...	...	85	...	...	...	...	...	...
Pupilla muscorum	...	...	...	75	...	...	...	...	...	...	82	83	...	85	...	...	*88*	...	...	91
Lauria cylindracea	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
L. anglica	...	*73*	74	75	76	...	...	...	...	81	...	83	84	85	...	87	88	...	...	91
Abida secale	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Acanthinula aculeata	72	73	74	75	76	77	...	79	80	81	82	83	...	85	86	87	88	89	90	...
A. lamellata	72	73	...	75	...	...	...	79	...	...	82	83	...	*85*	86	87	88	89	...	...
Vallonia costata	...	...	...	...	*76*	...	...	...	...	81	82	83	84	85	...	...	88	89	90	91
V. pulchella *agg*.	72	...	74	75	76	...	78	...	80	81	82	83	84	85	86	87	88	89	90	91
V. pulchella *seg*.	72	...	74	75	...	...	...	...	80	81	82	83	84	...	...	...	...	...	90	...
V. excentrica	...	...	...	75	76	...	78	...	80	81	82	83	84	85	86	...	...	...	...	91
Ena montana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
E. obscura	...	...	...	...	...	77	...	79	80	81	82	83	84	85	86	...	88	89	90	91
Marpessa laminata	...	...	...	...	...	...	...	...	...	...	...	...	...	85	...	...	...	89	...	91
Clausilia bidentata	72	73	74	75	76	77	...	79	80	81	82	83	84	85	86	87	88	89	90	91
C. dubia	...	...	...	...	...	...	...	...	...	...	...	*83*	...	*85*	...	...	...	...	...	...
C. rolphi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Laciniaria biplicata	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Balea perversa	72	73	74	75	76	...	...	79	80	81	82	83	*84*	85	86	87	88	89	...	91
Cecilioides acicula	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Testacella maugei	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
T. haliotidea	...	73	...	...	...	77	...	...	...	...	...	83	...	...	...	...	...	...	...	...
T. scutulum	...	...	...	...	76	...	...	...	...	...	...	...	...	85	86	*87*	88	...	...	...
Fruticicola fruticum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Helicodonta obvoluta	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Helicigona lapicida	...	...	...	...	...	...	...	...	80	...	...	...	...	...	...	...	...	...	...	...
Arianta arbustorum	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91

SCOTLAND.																					NAME OF SPECIES.
lands.					West Highlands.							N. Highlands.						Isles.			Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
92. Aberdeen South	93. Aberdeen Nth.	94. Banff	95. Elgin	96. Easterness	97. Westerness	98. Main Argyll	99. Dunbarton	100. Clyde Isles	101. Kintyre	102. South Ebudes	103. Mid Ebudes	104. North Ebudes	105. Ross West	106. Ross East	107. Sutherland East	108. Sutherland W.	109. Caithness	110. Outer Hebrides	111. Orkney	112. Zetland	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Catinella arenaria
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Succinea oblonga
92	*93*	*94*	*95*	...	...	*98*	*99*	*00*	...	...	*03*	...	*05*	...	...	...	*09*	*10*	*11*	...	S. putris
92	93	94	...	96	...	98	99	00	01	...	03	04	05	06	07	08	09	10	11	12	S. pfeifferi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	S. elegans
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Azeca goodalli
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	Cochlicopa lubrica
...	...	...	...	...	...	98	...	*00*	...	...	...	...	...	...	...	*08*	...	...	...	...	Pyramidula rupestris
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	...	12	Columella edentula
...	...	...	...	...	...	...	...	...	...	...	...	*04*	...	...	...	...	...	...	...	...	Truncatellina cylindrica
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T. cylindrica britannica
...	...	...	95	...	...	98	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Vertigo pusilla
...	...	...	95	96	97	98	...	00	01	...	...	...	...	06	07	08	...	10	...	...	V. antivertigo
92	...	94	95	96	97	98	...	00	01	...	...	04	05	06	07	08	...	10	...	...	V. substriata
...	...	94	95	...	...	98	...	00	01	...	03	...	05	06	07	08	09	10	11	12	V. pygmaea
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. genesii
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†V. parcedentata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. moulinsiana
92	...	...	...	96	...	98	99	...	...	...	...	04	...	...	...	...	...	10	...	...	V. lilljeborgi
...	...	...	...	...	...	...	...	...	...	...	03	...	...	...	...	...	...	...	...	...	V. alpestris
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	07	...	...	...	...	...	V. angustior
...	...	...	95	...	...	98	...	00	...	...	...	...	...	...	07	08	...	10	11	12	Pupilla muscorum
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	Lauria cylindracea
...	...	94	...	96	97	98	...	00	01	02	03	04	05	06	07	08	...	10	11	...	L. anglica
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Abida secale
92	...	94	95	96	97	98	99	00	01	...	03	...	05	...	07	...	09	...	...	...	Acanthinula aculeata
...	...	94	95	96	97	98	*99*	00	01	02	03	04	05	06	07	...	*09*	...	...	...	A. lamellata
92	...	...	...	...	...	...	...	...	...	02	...	...	...	...	...	...	...	10	...	...	Vallonia costata
92	93	94	95	96	...	98	...	00	01	02	03	04	...	...	07	08	...	...	11	...	V. pulchella *agg.*
92	93	94	...	...	...	...	...	00	01	...	...	...	...	...	...	...	...	10	11	...	V. pulchella *seg.*
...	...	...	...	...	...	...	...	00	...	02	03	04	...	...	07	08	...	10	11	...	V. excentrica
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Ena montana
...	...	94	95	96	...	...	99	00	...	...	...	...	...	...	...	...	...	...	...	...	E. obscura
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Marpessa laminata
...	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	*12*	Clausilia bidentata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10	...	...	C. dubia
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	C. rolphi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Laciniaria biplicata
...	93	94	95	...	97	98	99	00	01	02	03	04	05	...	07	...	09	10	11	12	Balea perversa
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Cecilioides acicula
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Testacella maugei
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T. haliotidea
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T. scutulum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Fruticicola fruticum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Helicodonta obvoluta
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Helicigona lapicida
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	Arianta arbustorum

NAME OF SPECIES. Numerals in small type indicate Holocene of dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	**SCOTLAND.**																			
	W. Lowlands.						**East Lowlands.**							**East High**						
	72. Dumfries	73. Kirkcudbright	74. Wigtown	75. Ayr	76. Renfrew	77. Lanark	78. Peebles	79. Selkirk	80. Roxburgh	81. Berwick	82. Haddington	83. Edinburgh	84. Linlithgow	85. Fife	86. Stirling	87. Perth West	88. Perth Mid	89. Perth East	90. Forfar	91. Kincardine
Theba pisana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Helix hortensis	...	73	...	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
H. nemoralis	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
H. aspersa	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
H. pomatia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*Hygromia limbata	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*H. cinctella	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H. subrufescens	72	73	...	75	76	77	78	79	80	81	82	83	84	*85*	86	87	88	89	90	91
H. striolata	72	73	74	75	76	77	*78*	79	80	81	82	83	*84*	85	86	87	88	89	*90*	91
H. hispida	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
H. liberta	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H. subvirescens	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Monacha granulata	...	*73*	*74*	75	76	...	...	...	80	81	82	83	*84*	85	...	...	...	89	90	91
M. cartusiana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
M. cantiana	...	...	...	...	...	...	...	...	...	...	...	...	...	*85*	...	...	...	...	...	...
Helicella caperata	...	...	74	75	*76*	77	*78*	*79*	80	81	82	83	*84*	85	86	...	...	...	90	...
H. gigaxi	...	...	...	...	...	...	...	...	...	81	82	...	...	...	...	...	...	...	...	...
H. virgata	...	73	*74*	75	...	...	...	...	...	...	*82*	...	...	*85*	...	*87*	...	...	...	...
H. itala	...	...	...	75	...	...	...	...	...	*81*	...	83	...	85	...	...	...	...	...	...
*H. elegans	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cochlicella acuta	...	73	74	75	...	...	...	...	...	...	...	*83*	...	...	...	...	...	...	...	...
Punctum pygmaeum	72	73	74	75	...	77	78	79	80	81	82	83	84	85	86	87	88	89	...	91
†Discus ruderatus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
D. rotundatus	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
Geomalacus maculosus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Arion intermedius	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	...	91
A. circumscriptus	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
A. hortensis	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
A. subfuscus	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	...	91
A. ater *agg.*	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
A. ater *seg.*	...	...	...	...	...	...	...	...	...	...	...	83	...	...	...	...	...	...	...	...
A. rufus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Euconulus fulvus	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
Vitrea crystallina	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
Oxychilus draparnaldi	...	...	...	*75*	76	77	...	...	...	...	...	83	...	85	86	...	88	89	90	91
O. cellarius	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
O. alliarius	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
O. helveticus	72	...	74	75	...	...	78	...	80	...	...	...	...	...	86	*87*	...	...	...	91
†Retinella petronella	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
R. radiatula	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
R. pura	72	73	74	75	76	...	78	79	80	81	82	83	84	85	86	87	88	89	90	91
R. nitidula	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
Zonitoides excavatus	72	73	74	75	76	77	...	...	...	...	...	...	84	...	86	87	88	...	...	*91*
Z. nitidus	72	73	74	75	...	...	...	*79*	80	81	82	83	84	...	86	87	88	89	...	...
Vitrina pellucida	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
V. major	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*V. pyrenaica	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

SCOTLAND.

lands.					West Highlands.							N. Highlands.						Isles.			Name of Species. Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
92. Aberdeen South	93. Aberdeen Nth.	94. Banff	95. Elgin	96. Easterness	97. Westerness	98. Main Argyll	99. Dunbarton	100. Clyde Isles	101. Kintyre	102. South Ebudes	103. Mid Edubes	104. North Ebudes	105. Ross West	106. Ross East	107. Sutherland East	108. Sutherland W.	109. Caithness	110. Outer Hebrides	111. Orkney	112. Zetland	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Theba pisana
92	93	94	95	96	97	98	99	00	*01*	02	03	04	05	06	07	08	09	10	11	12	Helix hortensis
...	...	...	...	96	97	98	99	00	01	02	03	04	...	...	...	...	...	...	...	...	H. nemoralis
92	93	94	95	96	97	98	99	00	01	02	03	04	...	...	...	...	...	10	11	...	H. aspersa
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. pomatia
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Hygromia limbata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*H. cinctella
92	*93*	94	95	96	97	98	99	00	01	02	03	04	*05*	06	07	...	...	...	...	...	H. subrufescens
92	...	...	...	...	...	98	99	...	01	...	03	...	...	...	*07*	...	...	...	...	...	H. striolata
...	...	...	...	...	...	98	99	00	01	02	03	04	...	...	...	...	...	10	11	...	H. hispida
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. liberta
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. subvirescens
...	*93*	94	95	96	...	98	...	00	01	02	03	04	...	...	...	...	...	10	...	...	Monacha granulata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	M. cartusiana
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	M. cantiana
92	...	...	*95*	96	...	98	99	00	*01*	...	03	04	...	06	*07*	*08*	09	10	11	12	Helicella caperata
...	...	*94*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. gigaxi
...	*93*	...	...	...	...	...	...	...	...	02	...	04	...	...	...	...	...	...	...	...	H. virgata
...	...	...	...	...	97	98	...	00	01	02	03	04	05	...	07	08	09	10	...	...	H. itala
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*H. elegans
...	...	...	...	...	...	...	...	00	01	02	03	04	...	...	...	08	09	10	...	...	Cochlicella acuta
92	93	94	95	96	97	98	99	00	01	...	...	04	05	06	07	08	09	10	11	12	Punctum pygmaeum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†Discus ruderatus
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	D. rotundatus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Geomalacus maculosu
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	Arion intermedius
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	A. circumscriptus
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	A. hortensis
92	...	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	...	A. subfuscus
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	A. ater *agg.*
...	...	...	...	...	...	...	...	...	...	...	...	04	...	06	...	...	...	...	...	...	A. ater *seg.*
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A. rufus
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	Euconulus fulvus
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	Vitrea crystallina
92	...	...	...	...	...	98	...	00	...	...	...	...	...	...	...	...	...	10	11	12	Oxychilus draparnaldi
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	O. cellarius
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	O. alliarius
92	...	94	*95*	...	...	98	99	00	*01*	...	03	...	...	...	...	...	...	...	...	...	O. helveticus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†Retinella petronella
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	R. radiatula
92	93	94	95	96	97	98	99	00	01	...	03	04	05	06	07	08	09	...	11	12	R. pura
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	...	R. nitidula
92	...	...	...	96	97	98	99	00	01	...	03	04	05	...	...	...	...	10	...	...	Zonitoides excavatus
92	...	94	*95*	96	...	98	99	00	01	02	03	...	05	06	...	...	...	10	...	...	Z. nitidus
92	93	94	95	96	97	98	99	00	01	...	03	04	05	06	...	08	09	10	11	12	Vitrina pellucida
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. major
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*V. pyrenaica

NAME OF SPECIES.	SCOTLAND.																			
	W. Lowlands.						East Lowlands.							East High						
Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	72. Dumfries	73. Kirkcudbright	74. Wigtown	75. Ayr	76. Renfrew	77. Lanark	78. Peebles	79. Selkirk	80. Roxburgh	81. Berwick	82. Haddington	83. Edinburgh	84. Linlithgow	85. Fife	86. Stirling	87. Perth West	88. Perth Mid	89. Perth East	90. Forfar	91. Kincardine
Milax gagates	*72*	*73*	*74*	...	...	...	*78*	...	...	81	...	83	...	...	*86*	*87*	...	...	...	...
M. sowerbyi	...	...	...	...	76	...	...	*79*	...	*81*	...	83	...	*85*	...	*87*	...	...	...	...
M. budapestensis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Limax tenellus	...	...	...	*75*	...	...	...	...	...	...	...	...	...	...	...	87	88	89	...	91
L. maximus	...	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
L. cinereoniger	...	...	...	...	...	...	...	...	...	...	...	83	...	...	...	87	88	89	90	...
L. flavus	...	73	...	75	76	77	...	...	...	81	...	83	...	85	...	...	...	...	...	...
L. marginatus	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
Agriolimax agrestis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. reticulatus	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
A. caruanae	...	...	...	...	...	...	...	...	...	...	...	83	...	...	...	...	...	...	...	...
A. laevis	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	...	...
BIVALVIA.																				
M. margaritifera	72	73	74	75	76	77	...	...	...	...	...	...	...	*85*	86	87	88	89	90	91
Unio pictorum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
U. tumidus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Anodonta cygnea	...	73	...	75	76	...	...	...	80	...	*82*	*83*	...	*85*	*86*	...	*88*	*89*	*90*	...
A. anatina	...	...	...	...	...	...	...	...	...	81	82	83	84	85	...	...	88	...	...	...
A. minima	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sphaerium rivicola	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
S. corneum	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	...
*S. transversum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
S. lacustre	...	...	...	...	76	77	78	...	*80*	*81*	82	83	84	85	86	...	88	...	...	...
Pisidium amnicum	...	...	...	...	76	77	78	...	...	81	82	83	...	85	86	87	88	...	...	...
P. casertanum	72	73	74	...	...	77	78	79	...	81	82	83	84	85	86	87	88	89	90	...
P. conventus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	87	...	...	...	...
P. personatum	72	73	74	...	...	77	78	79	...	81	82	83	84	85	86	87	88	89	90	...
P. obtusale	72	73	74	...	...	...	78	...	...	81	82	83	84	85	...	87	88	89	...	...
P. milium	72	73	74	75	...	77	78	79	80	81	82	83	84	85	86	87	88	89	90	...
P. pseudosphaerium	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. subtruncatum	72	73	74	75	...	77	78	...	80	81	82	83	84	85	86	87	88	89	90	...
P. supinum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. henslowanum	72	...	...	...	76	77	78	...	...	...	82	83	84	85	86	87	...	...	...	...
P. lilljeborgi	72	73	74	75	...	...	...	...	80	81	...	83	...	85	86	87	88	89	...	...
P. hibernicum	72	73	74	...	...	77	78	...	80	...	...	...	84	85	86	87	88	...	90	...
P. nitidum	72	73	74	75	...	77	78	79	80	81	82	83	84	85	86	87	88	89	90	...
P. pulchellum	72	73	74	...	...	...	...	79	...	...	...	...	...	...	*86*	...	88	89	...	...
P. moitessierianum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. tenuilineatum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
†P. vincentianum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dreissena polymorpha	...	...	...	...	76	77	...	...	...	...	...	83	...	...	86	...	88	...	...	...
Total number of species	75	82 + 2	64 + 4	71 + 4	69 + 3	70 + 4	60 + 2	61 + 1	67 + 2	74 + 5	80 + 3	94 + 7	68 + 5	80 + 9	80 + 3	80 + 4	80 + 4	75 + 2	62 + 2	50 + 2

SCOTLAND.																					
lands.					West Highlands.							N. Highlands.						Isles.			NAME OF SPECIES.
92. Aberdeen South	93. Aberdeen Nth.	94. Banff	95. Elgin	96. Easterness	97. Westerness	98. Main Argyll	99. Dunbarton	100. Clyde Isles	101. Kintyre	102. South Ebudes	103. Mid Ebudes	104. North Ebudes	105. Ross West	106. Ross East	107. Sutherland East	108. Sutherland W.	109. Caithness	110. Outer Hebrides	111. Orkney	112. Zetland	Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
92	...	...	...	...	...	...	*99*	00	...	...	...	04	*05*	...	...	...	...	10	11	...	Milax gagates
92	...	...	...	...	...	*98*	...	00	...	...	*03*	...	...	...	...	...	...	...	...	...	M. sowerbyi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10	...	...	M. budapestensis
...	...	...	...	96	...	...	...	*00*	...	02	...	...	...	...	...	...	...	...	...	...	Limax tenellus
92	93	94	95	96	97	98	99	00	01	02	*03*	04	05	06	07	...	09	10	11	12	L. maximus
92	...	94	95	96	97	98	99	00	01	...	...	...	05	...	07	...	...	...	...	...	L. cinereoniger
92	...	...	95	...	...	...	...	00	...	...	...	...	...	...	...	...	09	...	...	...	L. flavus
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	L. marginatus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*10*	...	...	Agriolimax agrestis
92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	A. reticulatus
92	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A. caruanae
92	93	94	95	96	97	98	99	00	01	...	*03*	04	05	06	07	08	09	10	11	12	A. laevis
																					BIVALVIA.
92	93	94	95	96	97	98	...	...	...	...	...	*04*	05	06	07	08	*09*	10	...	12	M. margaritifera
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Unio pictorum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	U. tumidus
...	...	*94*	*95*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Anodonta cygnea
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	09	...	...	...	A. anatina
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A. minima
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Sphaerium rivicola
92	...	...	95	96	...	98	99	00	01	...	03	...	...	...	07	08	09	10	11	12	S. corneum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*S. transversum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	06	...	...	...	...	...	...	S. lacustre
...	...	...	...	...	...	...	99	...	...	...	...	...	...	...	...	...	...	...	...	...	Pisidium amnicum
92	*93*	94	95	96	97	98	99	00	01	*02*	03	04	05	06	07	08	09	10	11	12	P. casertanum
...	...	...	...	96	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. conventus
92	93	94	...	96	...	98	...	00	01	*02*	03	04	05	06	07	08	09	10	11	12	P. personatum
...	...	...	95	96	97	98	99	00	01	*02*	03	04	05	06	...	08	...	10	11	12	P. obtusale
92	93	...	...	96	97	98	99	00	01	*02*	...	04	...	06	...	08	...	10	11	12	P. milium
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. pseudosphaerium
92	93	94	...	96	...	98	...	00	01	...	...	...	...	06	...	08	09	10	11	12	P. subtruncatum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. supinum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	09	...	...	12	P. henslowanum
...	...	...	95	96	...	98	99	00	01	...	...	04	05	...	07	08	09	10	11	12	P. lilljeborgi
92	...	94	95	96	...	98	99	00	01	...	...	...	...	...	07	08	09	10	11	12	P. hibernicum
92	...	94	95	96	...	98	...	00	01	...	03	...	05	06	07	08	09	10	11	12	P. nitidum
92	...	...	...	...	...	98	...	...	...	*02*	...	04	...	06	...	...	...	...	11	...	P. pulchellum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. moitessierianum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. tenuilineatum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†P. vincentianum
...	...	...	...	...	...	...	99	...	...	...	...	...	...	...	...	...	...	...	...	...	Dreissena polymorph
62 + *4*	39 + *5*	55 + *4*	60 + *5*	64	45	75 + *3*	61 + *2*	77 + *4*	64 + *2*	39 + *5*	60 + *4*	58 + *2*	52 + *2*	54	54 + *1*	52 + *2*	53 + *3*	70 + *1*	58 + *1*	46 + *2*	*Total number of specie*

NAME OF SPECIES.	IRELAND.																					
	Ulster.										Leinster.											
Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	113. Londonderry	114. Antrim	115. Down	116. Armagh	117. Monaghan	118. Tyrone	119E. Donegal East	119W. Donegal West	120. Fermanagh	121. Cavan	122. Louth	123. Meath	124. Dublin	125. Kildare	126. Wicklow	127. Wexford	128. Carlow	129. Kilkenny	130. Queen's Co. (Leix)	131. King's Co. (Offaly)	132. Westmeath	133. Longford
GASTROPODA.																						
Theodoxus fluviatilis	...	...	...	...	...	...	...	...	...	...	...	23	24	25	...	27	28	29	30	31	32	...
Viviparus viviparus	...	...	*15*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. fasciatus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Valvata cristata	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
V. macrostoma	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. piscinalis	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Pomatias elegans	...	...	...	...	...	...	...	...	...	...	...	...	*24*	...	...	...	...	...	...	...	...	...
Acme fusca	13	14	15	16	17	18	19	19	...	21	22	23	24	25	26	27	28	29	30	31	32	...
Hydrobia ventrosa	...	14	15	...	...	...	19	...	...	...	...	...	...	...	...	27	...	...	...	...	...	...
H. ulvae	13	14	15	...	...	18	19	19	...	...	22	23	24	...	26	27	...	...	...	...	...	...
Pseudamnicola confusa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	27	28	29	...	...	...	...
Potamopyrgus jenkinsi	13	14	15	16	...	18	19	19	20	...	22	23	...	25	26	27	28	29	...	...	...	...
Bythinella scholtzi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bithynia tentaculata	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
B. leachi	...	...	...	...	...	...	...	...	...	...	...	23	24	25	...	27	28	29	30	31	...	...
Assiminea grayana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Carychium minimum	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	...	28	29	30	31	32	33
C. minimum *seg.* [*agg.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	27	...	...	...	...	...	...
C. tridentatum	...	...	...	...	...	...	...	19	...	...	...	...	...	...	...	27	...	...	...	...	...	...
Leucophytia bidentata	13	...	15	...	...	...	...	19	...	...	22	23	24	...	26	...	...	...	...	...		...
Phytia myosotis	13	14	15	...	...	...	19	...	...	...	22	23	24	...	...	27	...	29	...	...	...	...
Lymnaea truncatula	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
L. glabra	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	27	...	...	...	...	...	...
L. palustris	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
L. stagnalis	13	14	15	16	17	18	19	...	20	21	22	23	24	25	...	27	28	29	30	31	32	33
L. auricularia	13	14	15	16	...	18	...	19	20	21	22	23	24	25	...	27	28	29	30	31	...	33
L. peregra	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
L. glutinosa	...	14	15	16	...	...	19	...	...	...	...	23	24	25	...	...	...	...	30	31	32	33
Aplexa hypnorum	13	14	15	...	17	...	19	19	...	21	22	23	24	25	26	27	28	29	30	31	32	...
Physa fontinalis	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Physa *spp.*	...	14	15	...	...	...	...	...	...	...	...	...	24	...	...	...	...	...	...	...	...	...
Planorbarius corneus	...	14	...	...	...	...	...	...	...	...	...	23	24	25	...	...	...	...	30	...	...	...
Menetus dilatatus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Planorbis carinatus	13	14	15	16	17	18	19	19	20	21	22	23	24	25	...	27	28	29	30	31	32	33
P. planorbis	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
P. vorticulus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. vortex	*13*	...	*15*	...	...	...	...	...	20	21	22	...	...	*25*	...	...	...	...	...	31	32	33
P. leucostoma	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	...
P. laevis	...	14	15	16	...	...	...	19	20	...	22	...	24	25	26	...	...	29	...	...	32	...
P. albus	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
P. acronicus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. crista	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
P. contortus	13	14	15	16	17	18	19	19	20	21	22	23	24	25	...	27	28	29	30	31	32	33
Segmentina complanata	...	14	15	16	17	...	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
S. nitida	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Acroloxus lacustris	...	14	15	16	17	18	...	...	20	21	22	23	24	...	...	27	28	29	30	31	32	33
Ancylus fluviatilis	13	14	15	16	17	18	19	19	20	21	22	23	24	...	26	27	28	29	30	31	32	...

IRELAND.																		
Connaught.								**Munster.**										NAME OF SPECIES. Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
134. Roscommon	135. Leitrim	136. Sligo	137. Mayo East	138. Mayo West	139. Galway West	140N. Galway N.E.	140S. Galway S.E.	141. Clare	142. Limerick	143. Tipperary N.	144. Tipperary S.	145. Waterford	146E. Cork East	146M. Cork Mid	147. Cork West	148N. Kerry North	148S. Kerry South	
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	...	...	...	Theodoxus fluviatilis
...	...	...	...	...	...	...	...	...	*42*	...	...	...	...	...	...	...	...	Viviparus viviparus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. fasciatus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Valvata cristata
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. macrostoma
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	V. piscinalis
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Pomatias elegans
...	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Acme fusca
...	...	...	...	...	...	40	...	41	...	...	...	...	...	...	...	...	...	‡Hydrobia ventrosa
...	...	36	...	38	39	40	40	41	42	...	...	45	46	46	47	48	48	‡H. ulvae
...	...	...	...	...	...	...	...	41	42	...	...	45	...	...	...	...	...	‡Pseudamnicola confusa
...	...	36	...	38	...	...	40	41	42	...	44	45	46	46	47	48	48	Potamopyrgus jenkinsi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Bythinella scholtzi
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	...	Bithynia tentaculata
...	...	...	...	...	...	...	40	...	...	43	...	...	...	...	...	...	...	B. leachi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	‡Assiminea grayana
34	35	36	37	38	39	40	40	41	...	43	44	45	46	46	47	48	48	Carychium minimum
...	...	...	...	...	...	...	...	...	42	...	...	...	...	...	...	...	48	C. minimum *seg*. [*agg*.
...	...	...	...	...	...	...	...	...	42	...	...	...	...	46	47	...	...	C. tridentatum
...	...	...	...	...	39	40	40	41	...	...	...	45	46	...	...	...	...	‡Leucophytia bidentata
...	...	36	...	38	39	...	40	41	42	...	...	45	46	...	47	48	48	‡Phytia myosotis
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Lymnaea truncatula
...	...	...	...	...	...	...	...	...	...	...	...	...	...	*46*	...	...	...	L. glabra
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	L. palustris
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	...	...	...	L. stagnalis
...	35	36	37	38	39	...	40	41	42	43	44	45	46	46	...	...	...	L. auricularia
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	L. peregra
34	...	36	...	...	...	40	40	41	...	...	...	...	...	...	...	...	...	L. glutinosa
34	35	36	...	38	39	40	40	41	42	43	44	45	46	46	...	48	48	Aplexa hypnorum
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Physa fontinalis
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47	...	...	*Physa *spp*.
...	...	*36*	...	...	...	...	...	...	42	...	...	...	...	...	...	...	*48*	Planorbarius corneus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Menetus dilatatus
34	35	36	...	...	...	...	40	41	42	43	44	...	46	46	...	...	...	Planorbis carinatus
34	35	36	...	...	39	40	40	41	42	43	44	45	46	46	47	48	...	P. planorbis
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. vorticulus
34	35	36	...	...	...	...	40	41	*42*	*43*	...	...	*46*	*46*	...	...	...	P. vortex
34	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	P. leucostoma
...	35	36	...	38	39	...	40	41	42	43	44	45	46	*46*	47	*48*	48	P. laevis
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	P. albus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P. acronicus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	P. crista
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	P. contortus
...	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Segmentina complanata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	S. nitida
...	35	36	...	...	...	40	40	41	42	43	44	...	46	46	...	...	...	Acroloxus lacustris
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Ancylus fluviatilis

NAME OF SPECIES.	IRELAND.																					
	Ulster.										Leinster.											
Numerals in small type indicate Holocene or dead shells *umerals in italics indicate ecords requiring confirmation, r adventitious introductions.*	113. Londonderry	114. Antrim	115. Down	116. Armagh	117. Monaghan	118. Tyrone	119E. Donegal East	119W. Donegal West	120. Fermanagh	121. Cavan	122. Louth	123. Meath	124. Dublin	125. Kildare	126. Wicklow	127. Wexford	128. Carlow	129. Kilkenny	130. Queen's Co. (Leix)	131. King's Co. (Offaly)	132. Westmeath	133. Longford
Catinella arenaria .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	30	31	...	...
Succinea oblonga .	...	14	...	...	...	...	*19*	...	20	...	...	*23*	...	...	...	...	...	...	...	...	...	...
S. putris . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
S. pfeifferi . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
S. elegans . . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Azeca goodalli . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cochlicopa lubrica .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Pyramidula rupestris .	...	14	*15*	...	17	...	19	19	20	21	22	23	24	25	...	27	28	29	30	31	32	33
Columella edentula .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	...	...
Truncatellina cylindrica	...	*14*	*15*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
T. cylindrica britannica	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Vertigo pusilla . .	13	14	...	...	...	...	19	19	...	...	...	...	24	...	...	27	...	...	...	...	...	...
V. antivertigo . .	13	14	15	16	17	...	...	19	20	21	22	23	24	25	26	27	28	29	30	31	32	...
V. substriata . .	13	14	15	16	17	...	19	19	20	21	22	23	24	25	26	27	28	29	30	31	...	...
V. pygmaea . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	...
V. genesii . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	30	31	...	...
V. parcedentata .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	31	...	...
V. moulinsiana . .	...	...	...	...	...	...	...	...	...	...	...	23	24	25	...	27	28	29	30	31	...	...
V. lilljeborgi . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. alpestris . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. angustior . .	13	14	15	...	...	...	19	19	...	...	...	...	...	25	...	...	28	29	...	31	...	...
Pupilla muscorum .	13	14	15	...	...	...	19	19	...	21	22	23	24	25	26	27	28	29	30	31	...	...
Lauria cylindracea .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
L. anglica . . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	...
Abida secale . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Acanthinula aculeata .	13	14	15	16	17	18	19	19	20	...	22	23	24	25	26	27	28	29	30	31	...	...
A. lamellata . .	13	14	15	16	17	18	19	19	20	21	22	*23*	*24*	*25*	26	27	28	29	30	31	...	...
Vallonia costata . .	13	14	15	...	17	...	19	19	*20*	21	22	23	24	25	26	...	28	29	30	31	...	...
V. puchella *agg*. . .	13	...	15	16	...	18	19	19	20	21	...	...	...	...	...	27	...	29	...	31	32	33
V. pulchella *seg*. .	13	14	15	16	17	...	19	19	...	...	22	23	24	25	26	...	28	29	30	31	...	33
V. excentrica . .	...	14	...	16	17	...	19	19	20	...	22	23	24	25	26	27	28	...	30	31	...	...
Ena montana . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
E. obscura . .	...	14	...	...	...	...	...	...	...	...	22	23	24	25	26	...	28	29	30	31	32	...
Marpessa laminata .	...	*14*	...	...	...	...	...	...	20	21	...	...	...	...	26	...	...	...	...	...	32	...
Clausilia bidentata .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
C. dubia . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C. rolphi . . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Laciniaria biplicata .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Balea perversa . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	...
Cecilioides acicula .	...	...	...	...	17	...	...	...	20	21	22	23	24	25	...	...	28	29	30	31	...	...
Testacella maugei .	...	...	...	...	...	...	...	...	...	...	...	...	24	...	...	...	...	29	...	...	...	...
T. haliotidea . .	...	...	...	...	...	18	...	...	...	...	...	...	24	...	...	...	...	...	...	...	...	...
T. scutulum . .	...	...	...	16	...	...	...	...	20	...	22	...	24	...	...	...	...	29	...	...	...	...
Fruticicola fruticum .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Helicodonta obvoluta .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Helicigona lapicida .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Arianta arbustorum .	13	14	*15*	16	...	...	...	19	20	21	...	...	...	...	...	...	...	...	...	...	32	...

IRELAND.																		NAME OF SPECIES.
Connaught.								Munster.										
134. Roscommon	135. Leitrim	136. Sligo	137. Mayo East	138. Mayo West	139. Galway West	140N. Galway N.E.	140S. Galway S.E.	141. Clare	142. Limerick	143. Tipperary N.	144. Tipperary S.	145. Waterford	146E. Cork East	146M. Cork Mid	147. Cork West	148N. Kerry North	148S. Kerry South	Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
...	...	...	...	38	...	...	...	...	...	43	...	...	...	...	...	...	...	Catinella arenaria
...	...	...	...	...	*39*	...	...	*41*	...	...	...	...	*46*	46	*47*	...	*48*	Succinea oblonga
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	S. putris
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	S. pfeifferi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	S. elegans
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Azeca goodalli
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Cochlicopa lubrica
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Pyramidula rupestris
34	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Columella edentula
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*48*	...	Truncatellina cylindrica
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T. cylindrica britannica
...	...	...	...	...	...	...	40	41	42	43	...	45	...	...	...	48	*48*	Vertigo pusilla
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	V. antivertigo
...	35	36	...	38	39	40	40	41	42	43	...	45	46	46	47	48	48	V. substriata
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	V. pygmaea
...	...	...	...	...	...	40	40	...	...	43	...	...	...	...	...	...	...	V. genesii
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†V. parcedentata
...	...	...	...	...	...	...	...	41	...	43	...	...	...	...	...	...	...	V. moulinsiana
...	35	...	...	...	39	...	40	41	...	...	...	...	...	...	47	48	48	V. lilljeborgi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. alpestris
...	...	36	...	38	39	...	...	41	...	43	...	45	46	*46*	47	48	48	V. angustior
34	...	36	...	38	39	40	40	41	42	...	44	45	46	...	47	48	48	Pupilla muscorum
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Lauria cylindracea
...	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	L. anglica
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Abida secale
...	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Acanthinula aculeata
...	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	A. lamellata
...	...	36	...	38	39	...	40	41	42	43	44	45	46	...	...	48	48	Vallonia costata
34	35	36	37	...	39	40	...	...	42	43	44	...	...	46	47	48	...	V. pulchella *agg.*
...	...	36	...	38	39	40	40	41	42	...	...	45	46	46	47	...	48	V. pulchella *seg.*
...	...	36	...	38	39	...	40	41	...	43	...	45	46	...	...	48	48	V. excentrica
...	...	...	...	...	...	...	...	...	...	...	...	...	46	...	...	...	...	Ena montana
34	35	36	...	...	...	...	40	41	42	43	44	45	...	...	...	48	...	E. obscura
...	...	*36*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Marpessa laminata
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Clausilia bidentata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	C. dubia
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	C. rolphi
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Laciniaria biplicata
34	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Balea perversa
...	...	...	...	...	39	40	40	41	42	43	44	45	46	46	...	...	...	Cecilioides acicula
...	...	...	...	...	...	...	...	...	...	...	44	45	46	46	...	...	...	Testacella maugei
...	...	...	...	...	...	...	40	41	...	...	...	...	46	46	47	...	48	T. haliotidea
...	...	...	...	...	...	...	40	...	42	...	...	45	46	...	...	...	...	T. scutulum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Fruticicola fruticum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Helicodonta obvoluta
...	...	...	...	...	...	...	...	...	...	...	...	...	46	...	...	...	...	Helicigona lapicida
...	35	36	...	...	...	...	...	...	*42*	...	...	...	...	...	...	*48*	...	Arianta arbustorum

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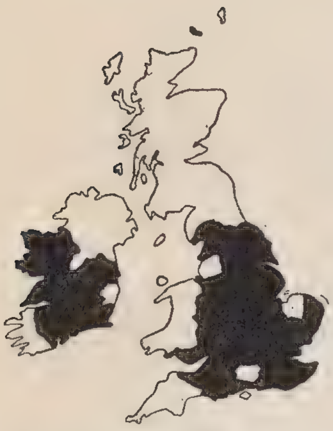
Theba pisana . .	...	...	...	...	...	...	...	...	...	...	22	23	24	...	...	...	...	...	...	...	...	...
Helix hortensis . .	13	14	15	16	...	18	19	19	...	...	22	23	24	25	26	27	28	29	30	31	32	...
H. nemoralis . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
H. aspersa. . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
H. pomatia . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hygromia limbata .	...	*14*	*15*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H. cinctella . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H. subrufescens .	13	14	15	16	17	18	...	19	20	21	...	...	24	...	26	27	28	29	30	31	...	...
H. striolata . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
H. hispida. . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
H. liberta . . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H. subvirescens . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Monacha granulata .	...	...	*15*	...	...	18	*19*	...	...	...	...	...	24	25	...	...	...	...	...	...	...	...
M. cartusiana . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
M. cantiana . .	...	...	...	...	...	...	...	...	...	...	...	...	*24*	...	...	...	...	...	...	...	...	...
Helicella caperata .	13	14	...	16	...	...	19	19	...	...	22	23	24	25	26	27	28	29	30	31	32	33
H. gigaxi . . .	...	...	...	...	...	...	...	...	...	...	...	...	...	*25*	...	...	...	...	...	...	...	...
H. virgata . .	...	14	15	16	17	...	...	...	...	...	22	23	24	25	26	27	28	29	30	31	32	33
H. itala . . .	13	14	...	16	17	...	19	19	...	...	22	23	24	25	26	27	28	29	30	31	32	33
H. elegans. . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cochlicella acuta .	13	14	15	16	17	...	19	19	...	...	22	23	24	25	26	27	28	29	30	31	32	...
Punctum pygmaeum .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	...
Discus ruderatus .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
D. rotundatus . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Geomalacus maculosus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Arion intermedius .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	...
A. circumscriptus .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
A. hortensis . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
A. subfuscus . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
A. ater *agg*. . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
A. ater *seg*. . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. rufus . . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Euconulus fulvus .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Vitrea crystallina .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Oxychilus draparnaldi	...	14	...	...	...	...	...	...	...	...	22	23	24	25	26	27	28	29	...	31	...	...
O. cellarius . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
O. alliarius . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	...
O. helveticus . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Retinella petronella .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
R. radiatula . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
R. pura . . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
R. nitidula . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Zonitoides excavatus .	13	...	*15*	...	...	18	19	19	20	...	...	...	24	...	26	27	28	29	...	...	...	...
Z. nitidus . . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Vitrina pellucida .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
V. major . . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. pyrenaica . .	...	...	...	...	...	...	...	...	...	...	22	23	...	...	...	...	...	...	...	...	...	...

IRELAND.																		
Connaught.								Munster.										NAME OF SPECIES. Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
134. Roscommon	135. Leitrim	136. Sligo	137. Mayo East	138. Mayo West	139. Galway West	140N. Galway N.E.	140S. Galway S.E.	141. Clare	142. Limerick	143. Tipperary N.	144. Tipperary S.	145. Waterford	146E. Cork East	146M. Cork Mid	147. Cork West	148N. Kerry North	148S. Kerry South	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Theba pisana
...	...	...	...	*38*	...	...	40	41	42	43	44	...	...	...	...	...	...	Helix hortensis
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	H. nemoralis
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	H. aspersa
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. pomatia
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Hygromia limbata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*H. cinctella
...	35	36	...	38	39	40	...	41	42	43	44	45	46	46	47	48	48	H. subrufescens
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	H. striolata
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	H. hispida
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. liberta
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. subvirescens
...	...	36	37	38	...	...	...	41	42	...	...	45	46	...	47	48	48	Monacha granulata
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	M. cartusiana
...	...	...	...	...	...	...	...	...	...	...	...	...	*46*	...	...	...	...	M. cantiana
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Helicella caperata
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H. gigaxi
34	...	...	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	H. virgata
34	...	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	H. itala
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*H. elegans
34	...	36	...	38	39	40	40	41	...	43	44	45	46	46	47	...	48	Cochlicella acuta
34	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Punctum pygmaeum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†Discus ruderatus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	D. rotundatus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47	...	48	Geomalacus maculosus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Arion intermedius
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	A. circumscriptus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	A. hortensis
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	A. subfuscus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	A. ater *agg.*
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A. ater *seg.*
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A. rufus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Euconulus fulvus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Vitrea crystallina
...	35	...	...	...	39	40	40	41	42	43	44	45	46	46	...	48	...	Oxychilus draparnaldi
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	O. cellarius
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	O. alliarius
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	O. helveticus
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	†Retinella petronella
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	R. radiatula
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	R. pura
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	R. nitidula
...	...	36	...	38	39	...	40	41	42	...	44	45	46	46	47	48	48	Zonitoides excavatus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Z. nitidus
34	35	36	...	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Vitrina pellucida
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	V. major
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*V. pyrenaica

NAME OF SPECIES.	IRELAND.																					
	Ulster.										Leinster.											
Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*	113. Londonderry	114. Antrim	115. Down	116. Armagh	117. Monaghan	118. Tyrone	119E. Donegal East	119W. Donegal West	120. Fermanagh	121. Cavan	122. Louth	123. Meath	124. Dublin	125. Kildare	126. Wicklow	127. Wexford	128. Carlow	129. Kilkenny	130. Queen's Co. (Leix)	131. King's Co. (Offaly)	132. Westmeath	133. Longford
Milax gagates . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
M. sowerbyi . .	13	14	15	16	17	18	19	19	...	21	22	23	24	25	26	27	28	29	30	31	32	33
M. budapestensis .	...	...	...	...	...	...	...	...	...	...	...	...	24	...	...	...	...	29	...	...	...	...
Limax tenellus . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
L. maximus . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
L. cinereoniger .	13	14	15	...	...	18	...	19	...	...	...	...	24	...	26	27	28	29	30	...	...	...
L. flavus . . .	13	14	15	16	17	18	19	19	...	21	22	23	24	25	26	27	28	29	30	31	32	...
L. marginatus . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	...
Agriolimax agrestis .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. reticulatus . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
A. caruanae . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. laevis . . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
BIVALVIA.																						
M. margaritifera .	13	14	15	16	...	18	19	19	20	21	22	...	24	25	26	27	28	29	30	...	...	...
Unio pictorum . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
U. tumidus . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Anodonta cygnea .	13	14	15	16	17	...	...	...	20	21	22	23	24	25	...	...	...	...	30	31	32	33
A. anatina . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	33
A. minima . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sphaerium rivicola .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
S. corneum . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
*S. transversum .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
S. lacustre . .	...	14	15	16	17	...	...	...	...	...	22	23	24	25	26	27	28	29	30	...	...	...
Pisidium amnicum .	13	14	15	16	...	18	...	...	20	21	22	23	24	25	...	27	28	29	30	31	32	33
P. casertanum . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
P. conventus . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. personatum . .	13	14	15	...	17	18	19	19	...	21	22	23	24	...	26	27	28	29	30	...	32	33
P. obtusale . .	13	14	15	...	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	...	...
P. milium . .	...	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
P. pseudosphaerium .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. subtruncatum .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
P. supinum . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
P. henslowanum .	13	14	15	16	17	18	...	...	20	21	...	...	24	25	...	...	28	29	30	31	...	...
P. lilljeborgi . .	...	14	15	16	...	18	19	19	20	...	...	...	24	25	26	...	...	...	...	...	...	...
P. hibernicum . .	13	14	15	16	17	18	19	19	20	...	...	...	24	25	26	27	28	29	30	31	32	...
P. nitidum . .	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
P. pulchellum . .	...	14	15	16	...	...	19	19	...	21	...	23	24	...	...	27	28	29	...	...	32	33
P. moitessierianum .	...	14	...	...	...	...	...	...	...	...	...	...	24	...	...	...	...	...	...	...	...	...
P. tenuilineatum .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
†P. vincentianum .	...	...	15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dreissena polymorpha	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total number of species	85 + *1*	103 + *3*	92 + *8*	86	80	77	84 + *1*	87	80 + *1*	81	94	96 + *1*	108 + *3*	92 + *3*	86	95	96	100	95	87	80	61

IRELAND.																		
Connaught.								Munster.										NAME OF SPECIES. Numerals in small type indicate Holocene or dead shells. *Numerals in italics indicate records requiring confirmation, or adventitious introductions.*
134. Roscommon	135. Leitrim	136. Sligo	137. Mayo East	138. Mayo West	139. Galway West	140N. Galway N.E.	140S. Galway S.E.	141. Clare	142. Limerick	143. Tipperary N.	144. Tipperary S.	145. Waterford	146E. Cork East	146M. Cork Mid	147. Cork West	148N. Kerry North	148S. Kerry South	
34	…	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	Milax gagates
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	M. sowerbyi
…	…	…	…	…	…	…	…	41	…	…	…	…	46	46	…	…	48	M. budapestensis
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	Limax tenellus
34	35	36	*37*	38	39	40	40	41	42	43	44	45	46	46	47	48	48	L. maximus
…	…	36	…	38	…	…	40	41	…	…	…	45	…	…	47	48	48	L. cinereoniger
34	35	36	…	38	39	40	40	41	42	43	44	45	46	46	47	48	48	L. flavus
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	L. marginatus
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	Agriolimax agrestis
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	A. reticulatus
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	A. caruanae
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	A. lævis
																		BIVALVIA.
…	…	36	37	38	39	…	40	41	…	…	44	45	46	46	47	48	48	M. margaritifera
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	Unio pictorum
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	U. tumidus
34	35	36	…	38	39	40	40	41	42	43	…	…	…	…	…	…	…	Anodonta cygnea
34	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	A. anatina
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	A. minima
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	Sphaerium rivicola
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	…	48	48	S. corneum
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	*S. transversum
…	…	…	…	…	…	40	40	41	42	43	44	45	46	46	…	…	…	S. lacustre
34	…	…	…	…	…	40	40	41	42	43	44	45	46	46	…	48	…	Pisidium amnicum
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	P. casertanum
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	48	P. conventus
…	35	36	…	38	39	40	40	41	42	43	44	45	…	46	47	48	48	P. personatum
34	35	36	37	38	39	40	40	41	…	43	…	45	…	46	47	48	48	P. obtusale
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	…	48	P. milium
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	P. pseudosphaerium
34	35	36	…	38	39	40	40	41	42	43	44	45	46	46	…	48	48	P. subtruncatum
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	P. supinum
…	…	36	…	…	…	40	40	41	42	43	44	…	…	…	…	…	…	P. henslowanum
…	…	36	37	38	39	40	40	41	…	43	…	…	…	…	47	48	48	P. lilljeborgi
34	…	36	…	38	39	40	40	41	…	43	44	45	46	46	47	48	48	P. hibernicum
34	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48	48	P. nitidum
…	…	36	37	38	39	40	40	41	42	43	44	45	…	46	…	48	48	P. pulchellum
…	…	…	…	…	…	…	40	…	…	43	44	…	…	…	…	…	…	P. moitessierianum
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	P. tenuilineatum
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	†P. vincentianum
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	Dreissena polymorpha
74 + *1*	79	95 + *2*	56 + *1*	90 + *1*	91	89	106	109	95 + *3*	94 + *1*	91	95	96 + *3*	91 + *4*	86	85 + *3*	90 + *2*	*Total number of species*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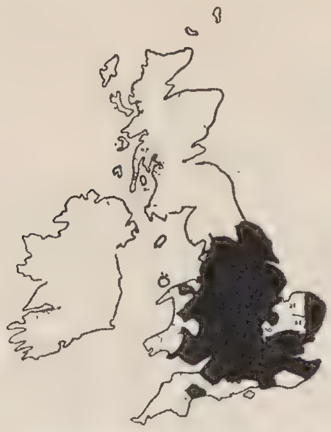
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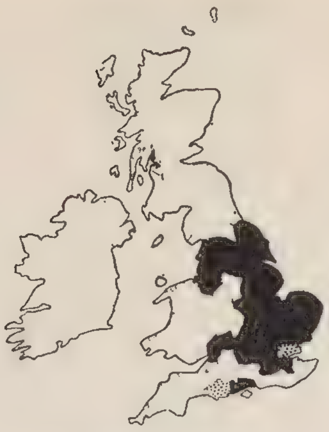
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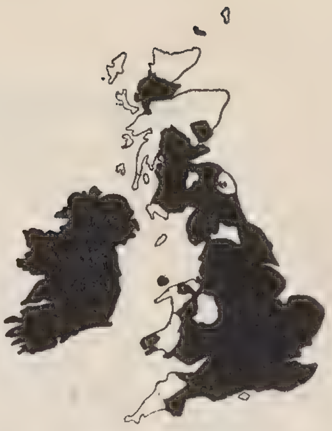
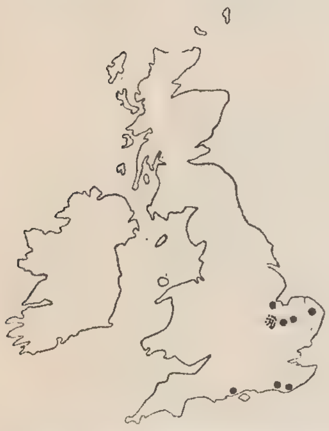

Valvata cristata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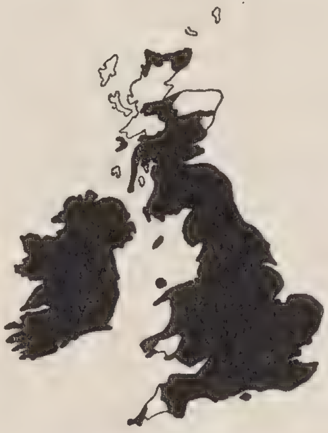
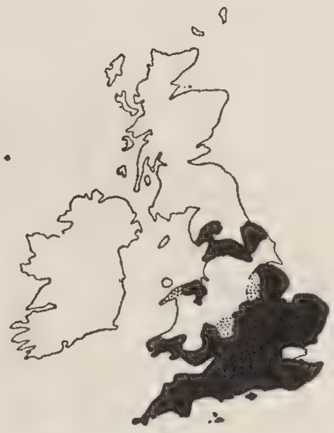

Valvata piscinalis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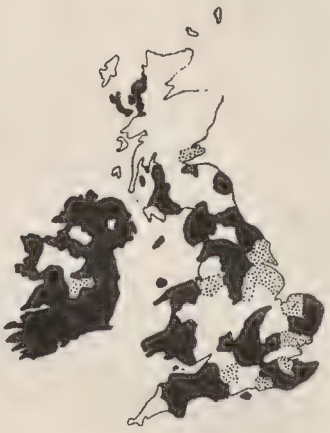
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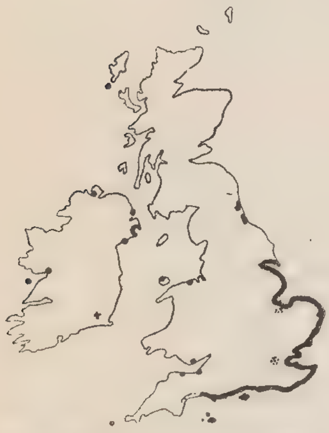
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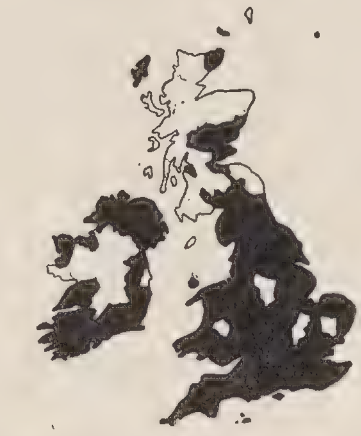
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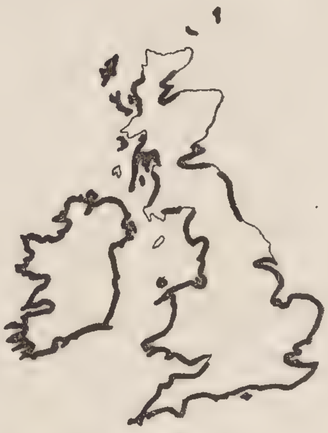
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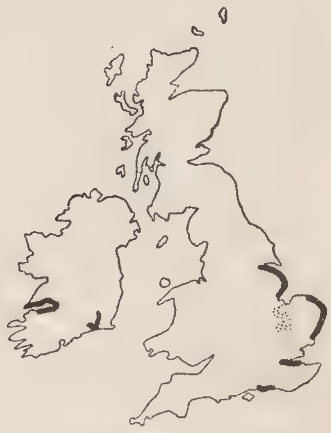
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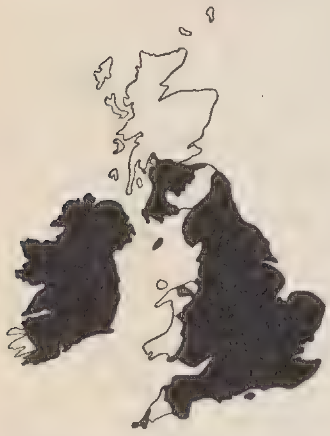
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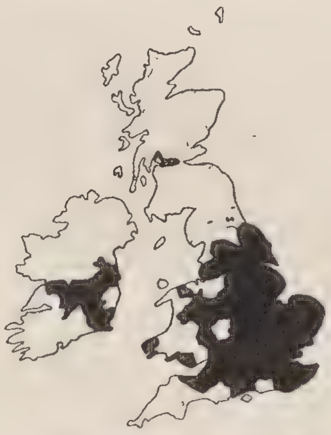
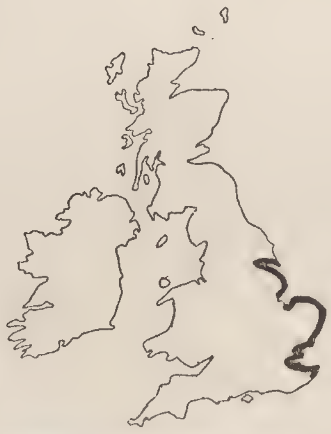

Bithynia leachi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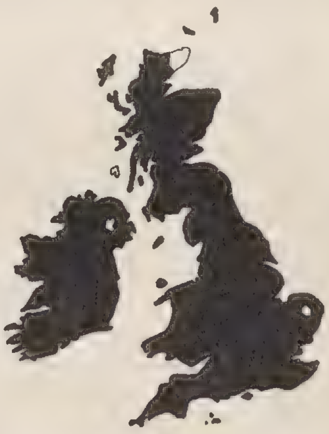
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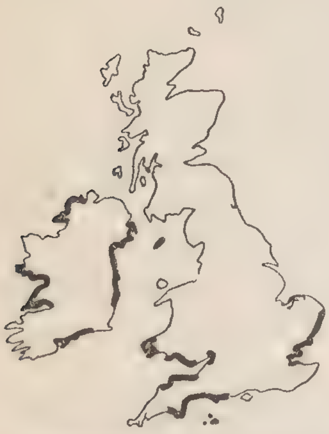
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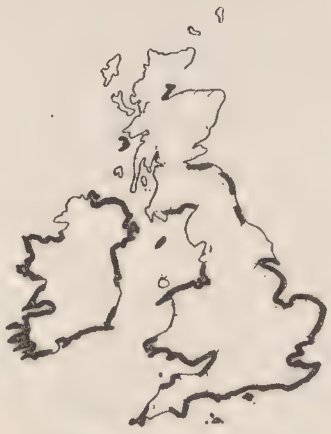
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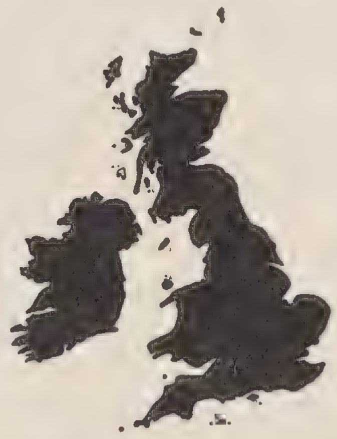
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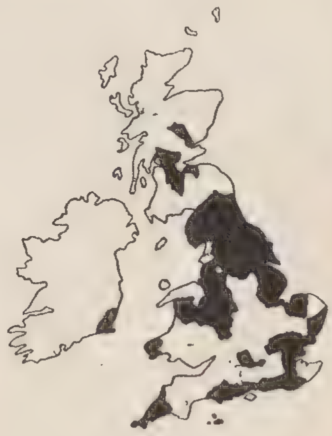
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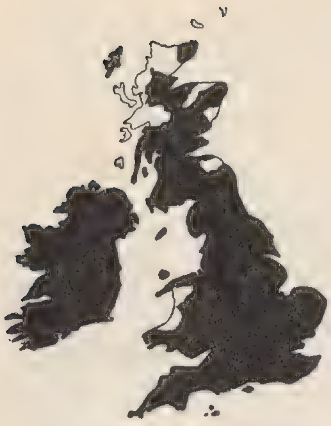
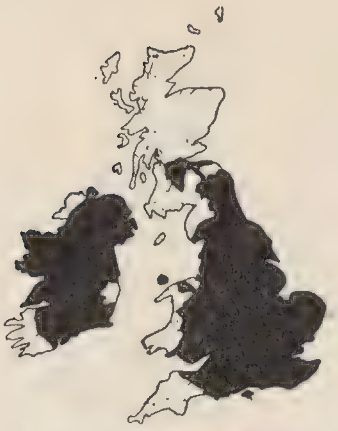


Lymnaea palustris



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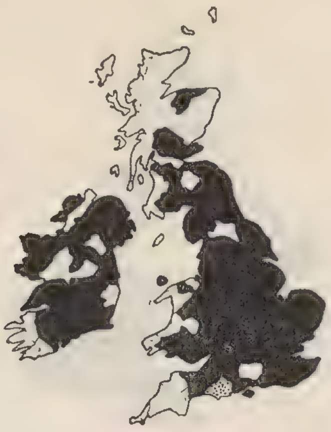

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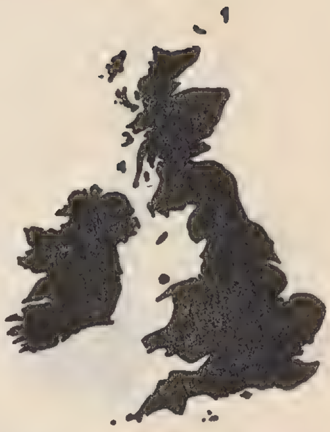

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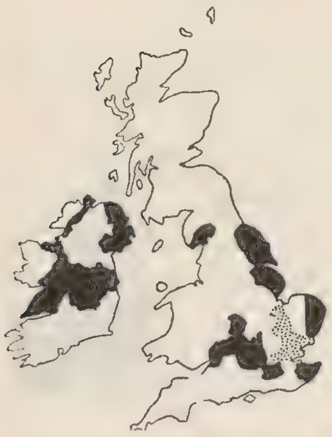

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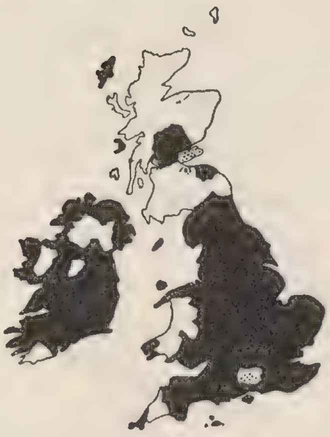
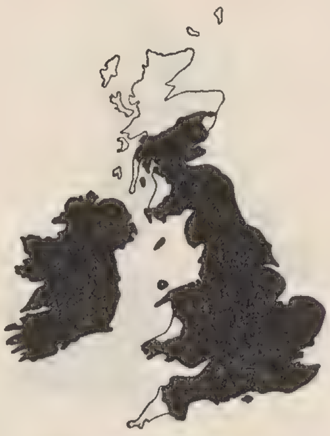
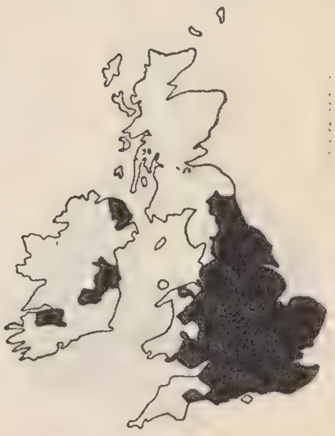


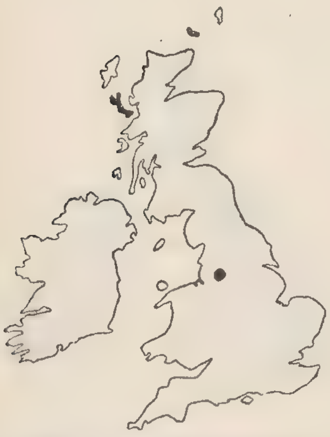
Aplexa hypnorum



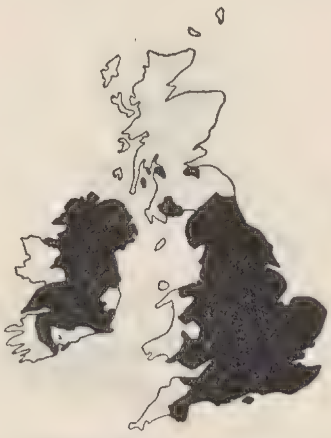
Physa fontinalis



Planorbarius corneus



Menetus dilatatus



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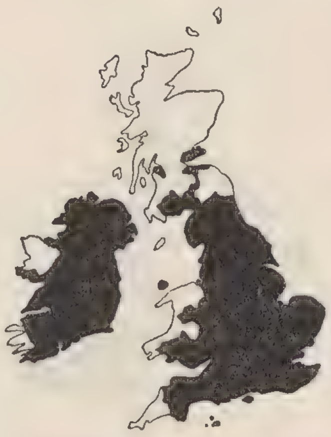
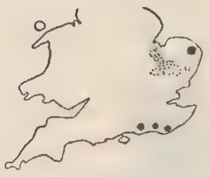
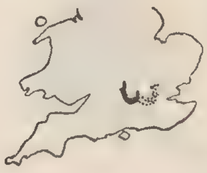


Planorbis planorbis



Planorbis vorticulus



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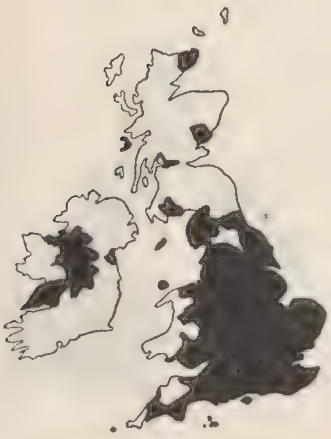
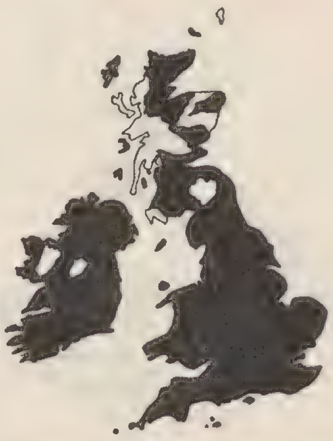
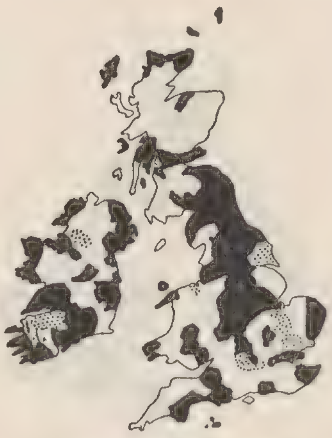


Planorbis vortex



Planorbis leucostoma



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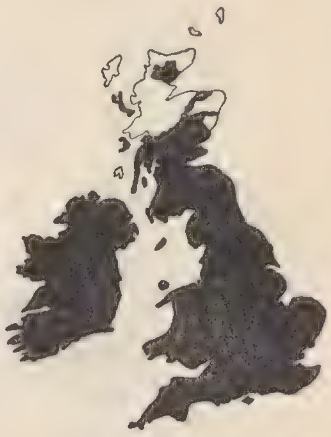

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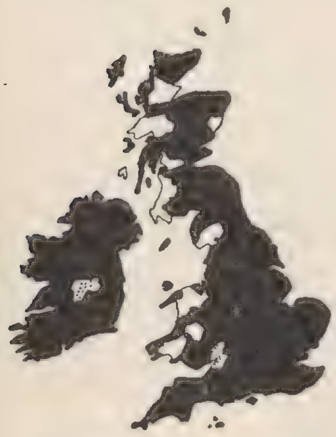
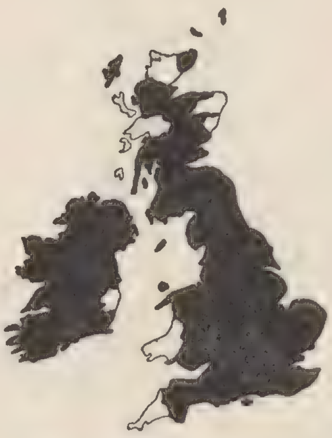


Planorbis crista



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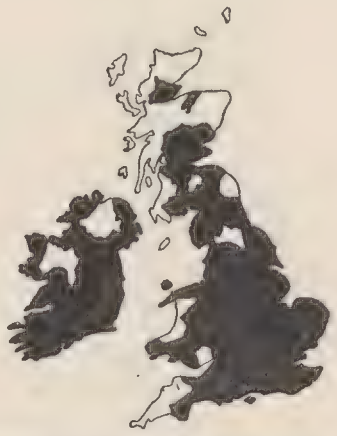
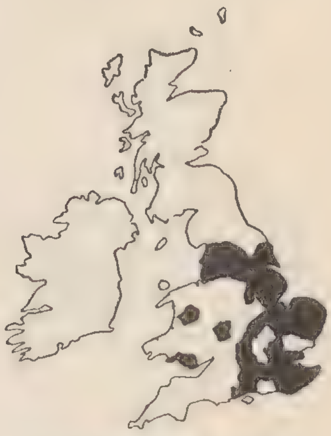
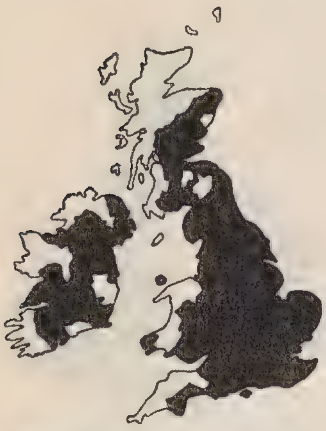


Segmentina complanata



Segmentina nitida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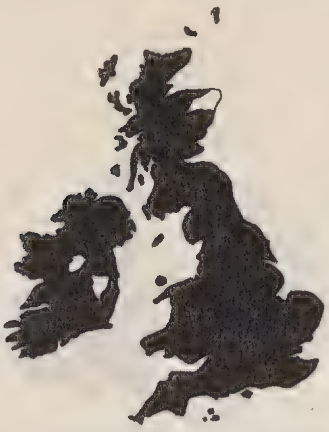
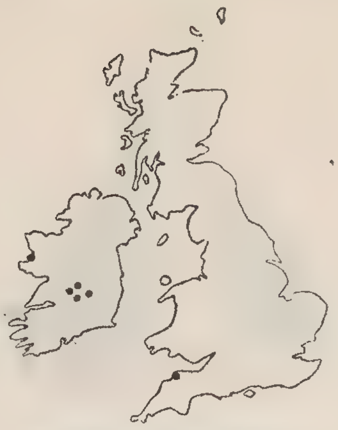
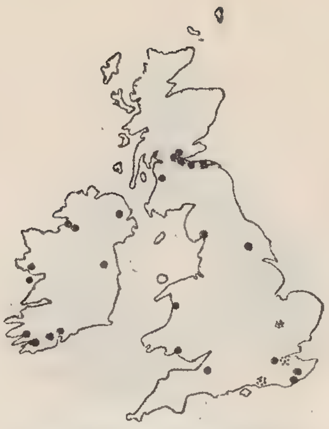

Ancylus fluviatilis


Catinella arenaria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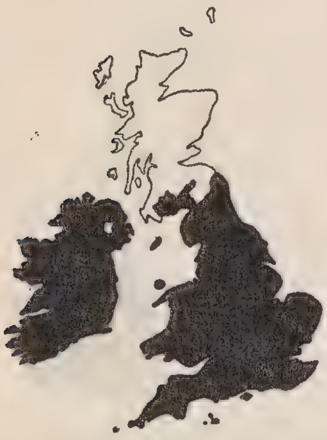
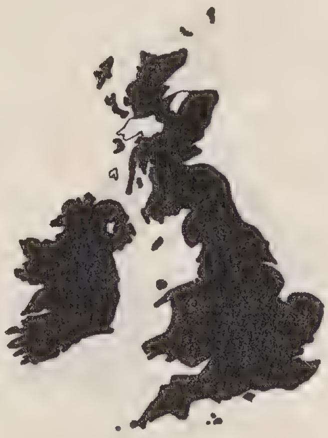
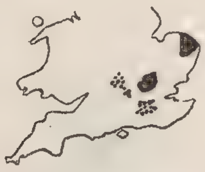
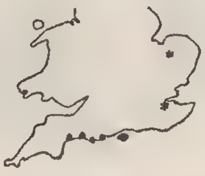
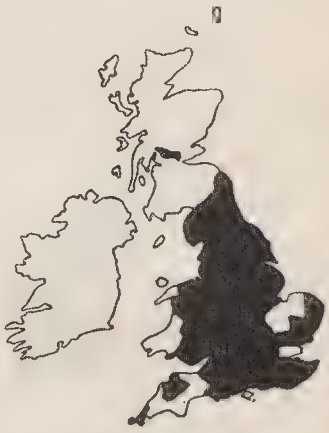
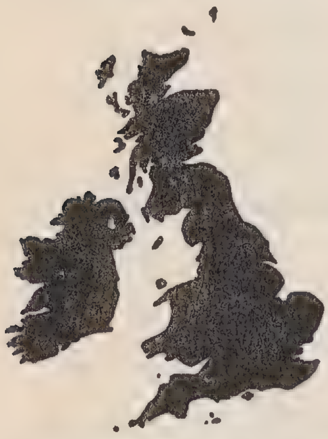

Succinea putris

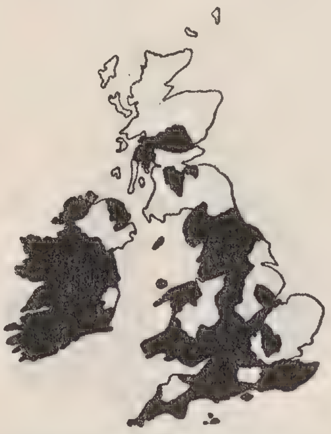

Succinea pfeifferi


Succinea elegans


T. cylindrica britannica


Azeca goodalli


Cochlicopa lubrica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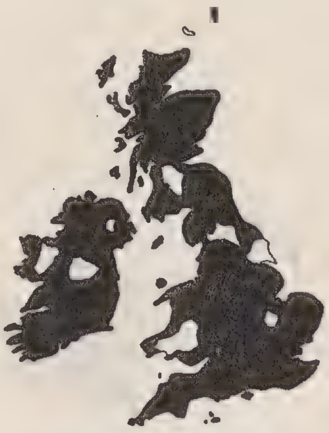
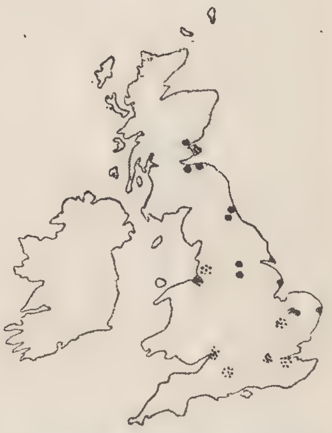

Columella edentula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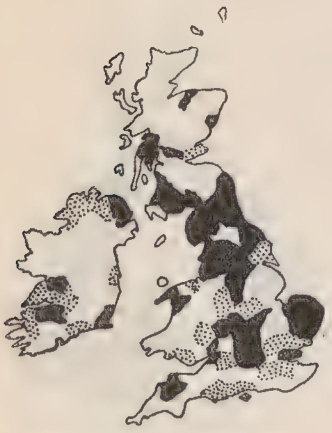
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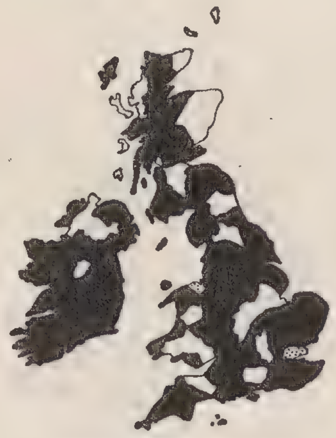
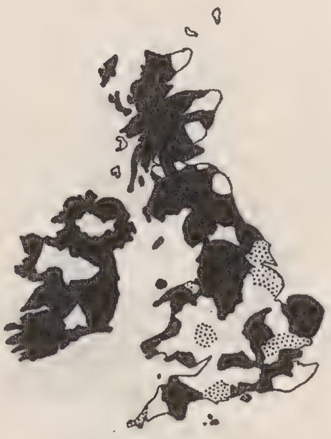
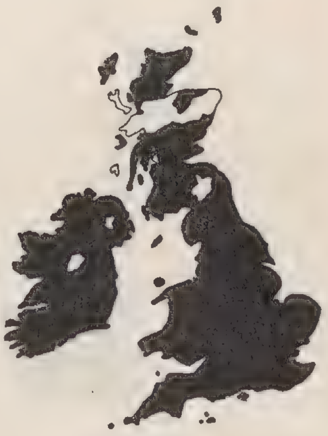

Vertigo antivertigo


Vertigo substriata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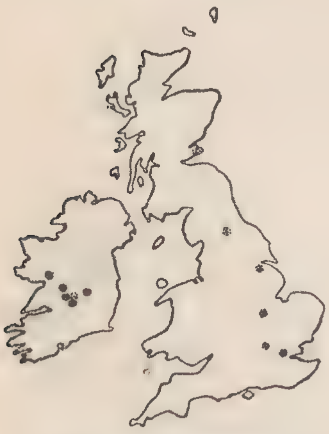
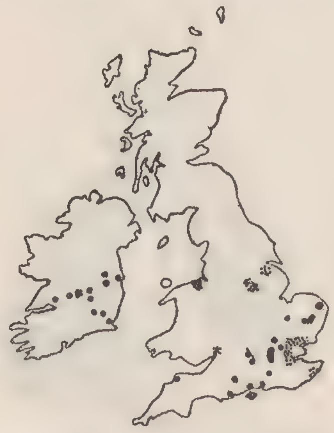

Vertigo genesii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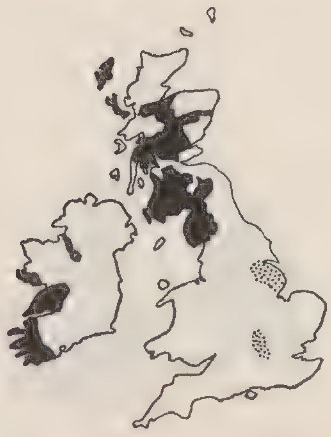
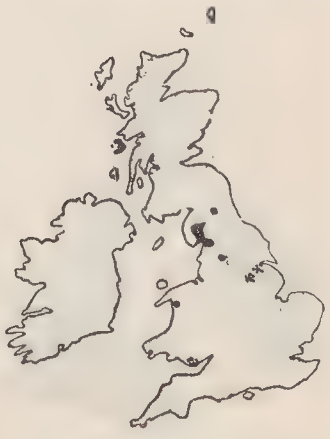
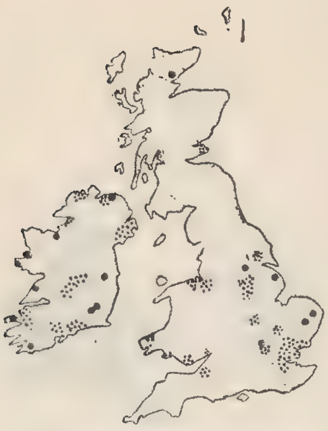
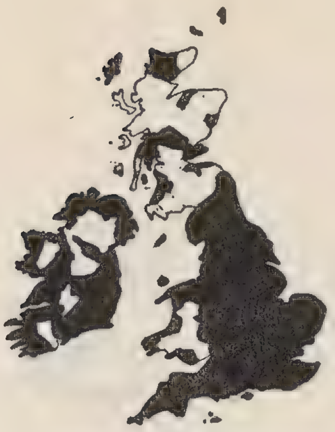

Vertigo lilljeborgi

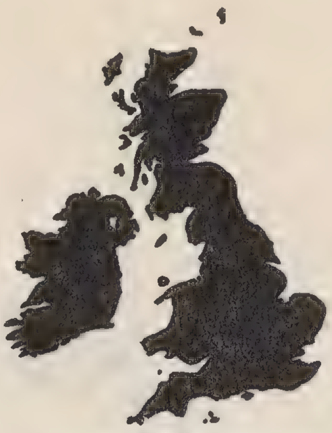

Vertigo alpestris



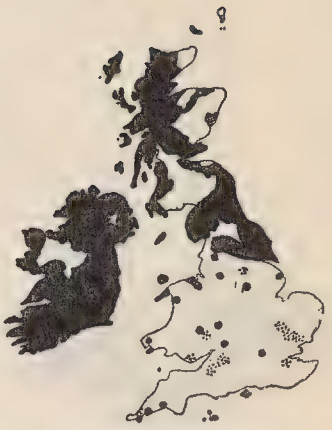
Vertigo angustior



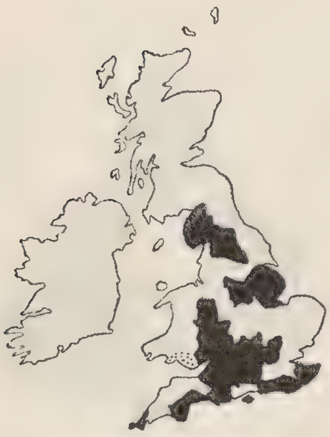
Pupilla muscorum



Lauria cylindracea



Lauria anglica



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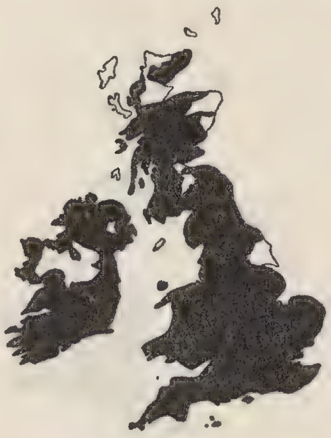
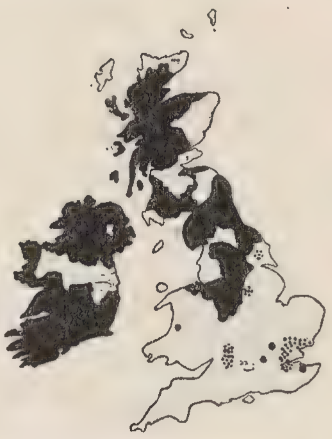


Acanthinula aculeata



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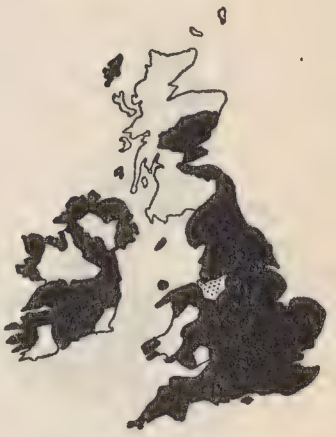
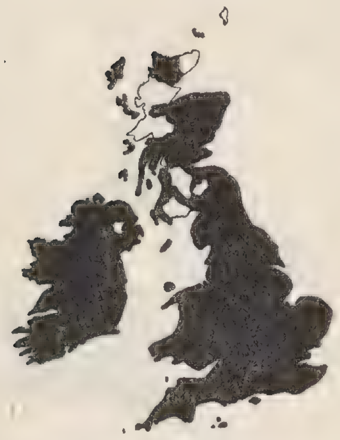


Vallonia costata



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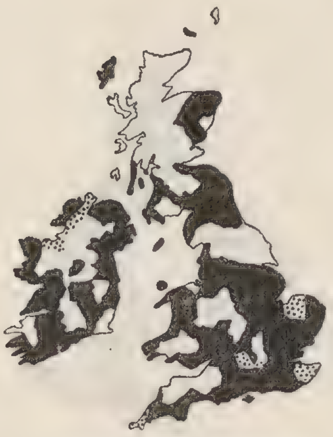

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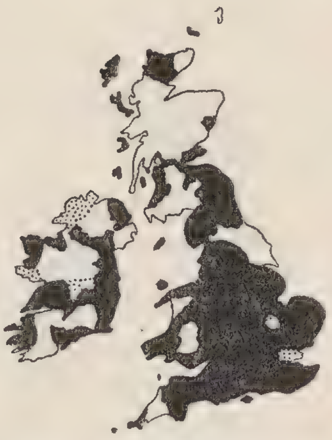
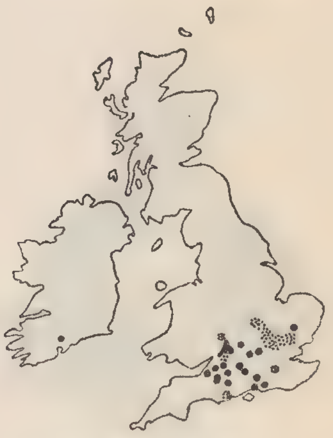
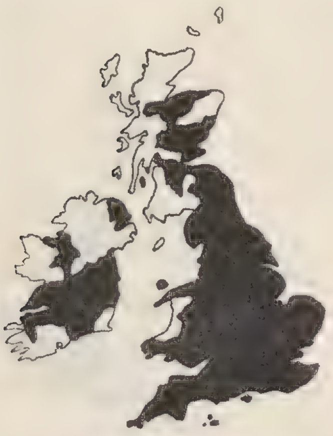


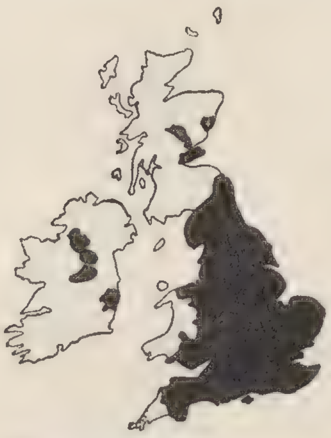
Vallonia excentrica



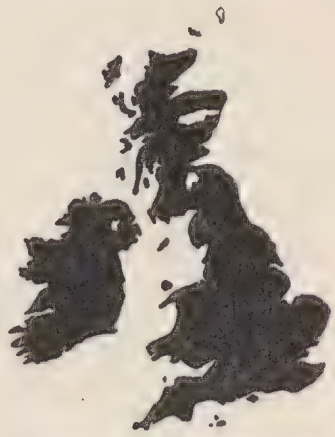
Ena montana



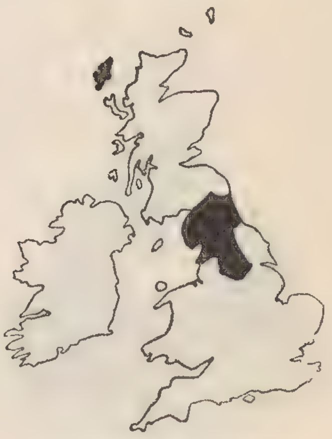
Ena obscura



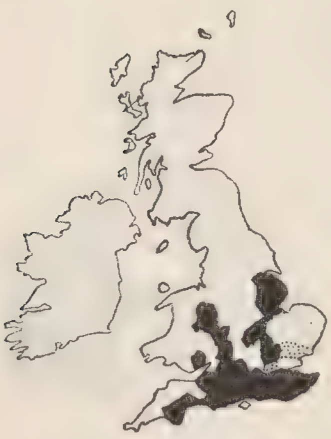
Marpessa laminata



Clausilia bidentata



Clausilia dubia



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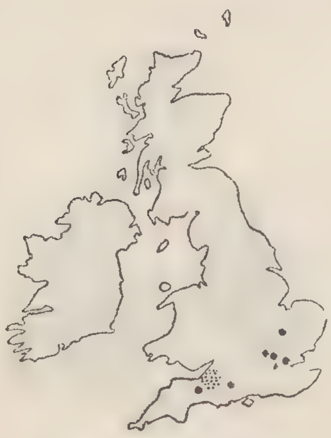

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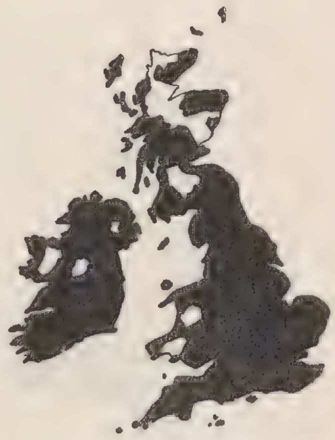
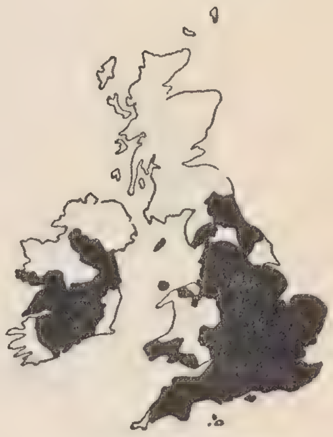
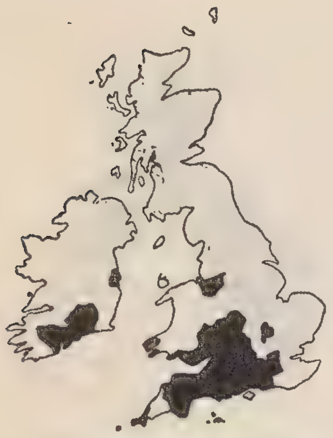


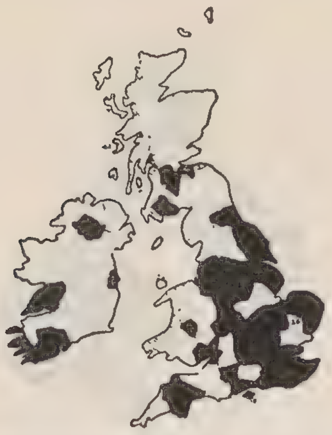
Balea perversa



Cecilioides acicula



Testacella maugei



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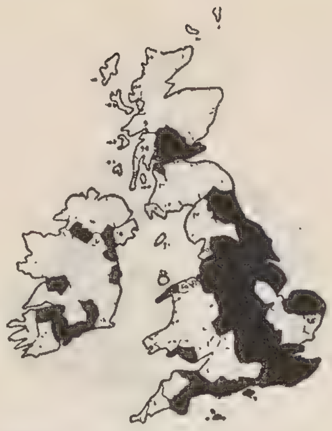
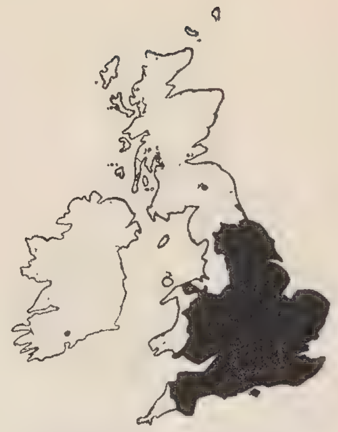
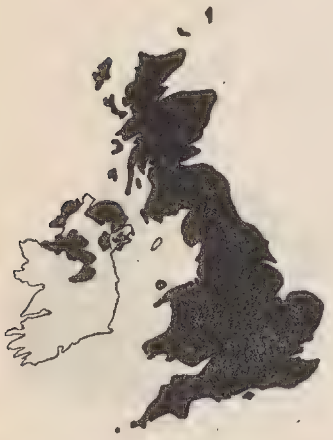


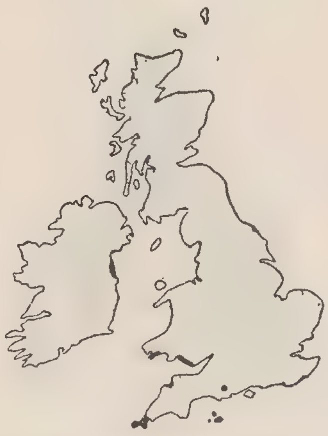
Testacella scutulum



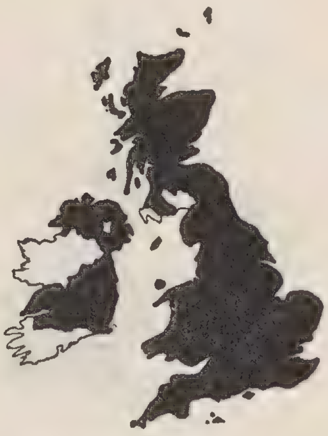
Helicigona lapicida



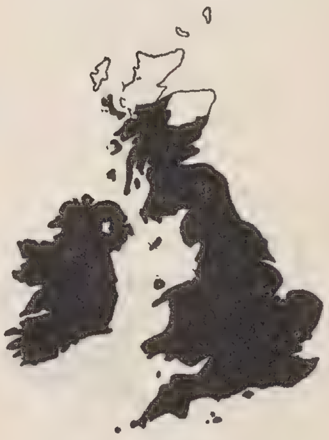
Arianta arbustorum



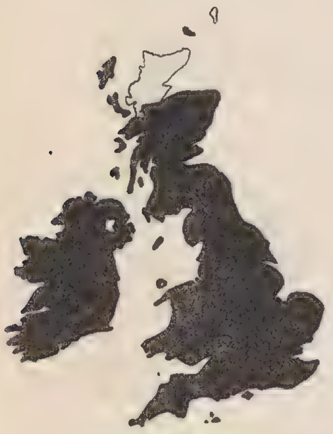
Theba pisana



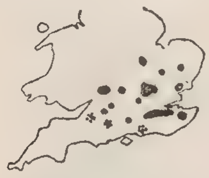
Helix hortensis



Helix nemoralis



Helix aspersa



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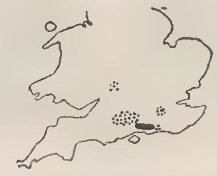
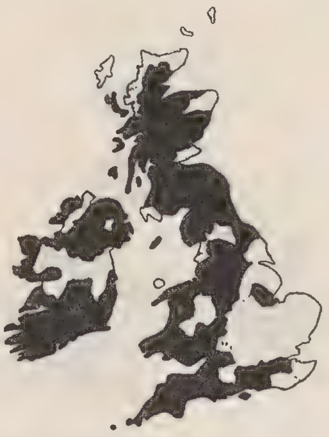
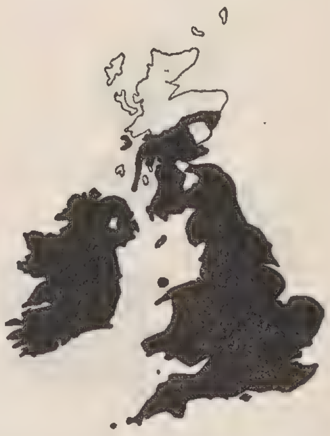


Helicodonta obvoluta



Hygromia subrufescens



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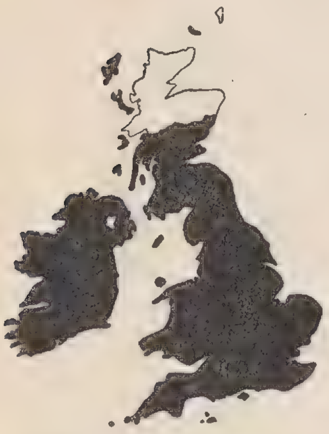

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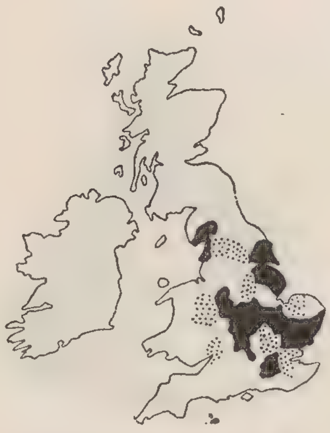

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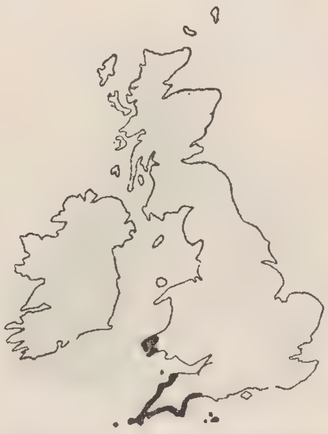

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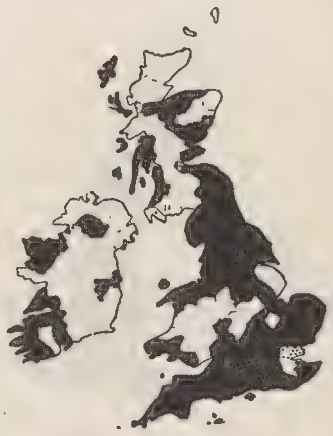
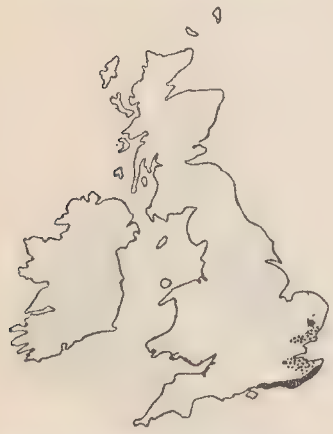
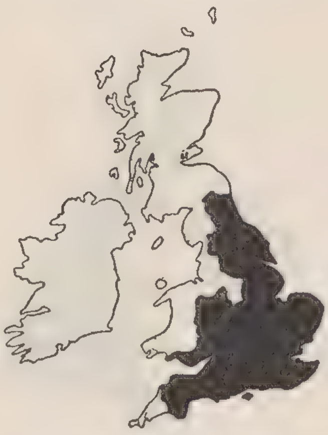


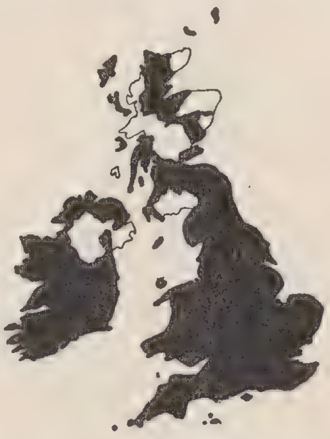
Monacha granulata



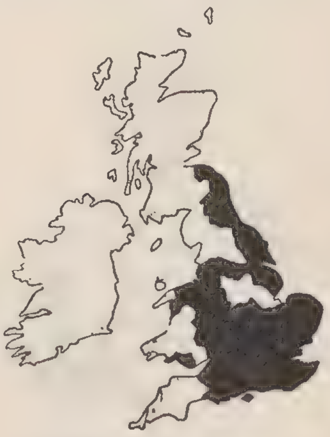
Monacha cartusiana



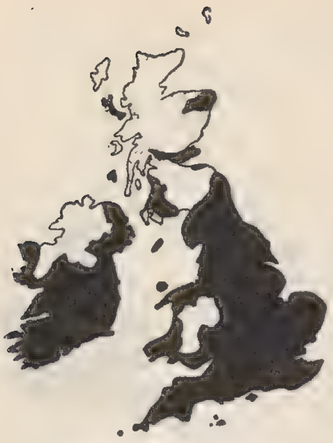
Monacha cantiana



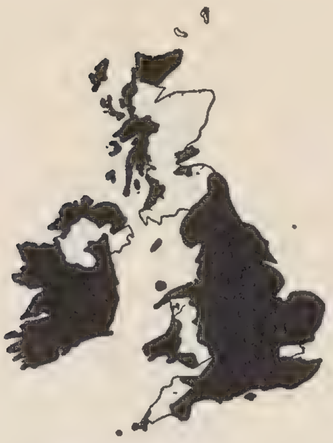
Helicella caperata



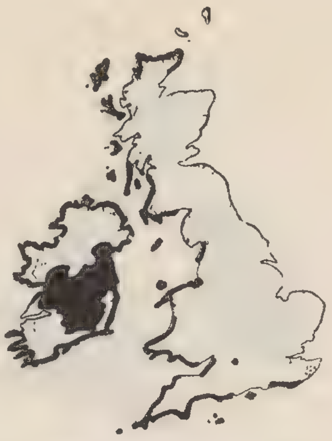
Helicella gigaxi



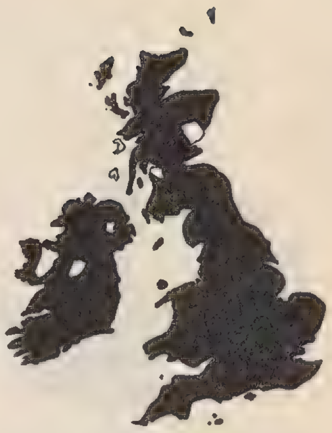
Helicella virgata



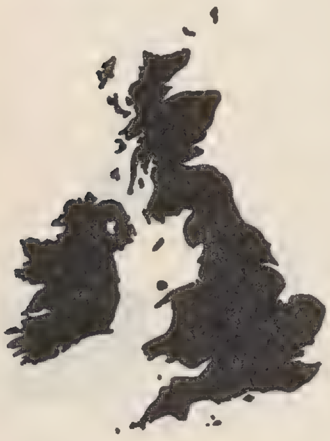
Helicella itala



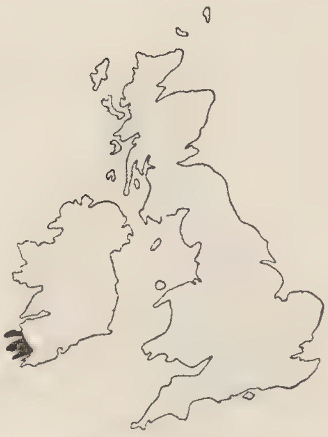
Cochlicella acuta



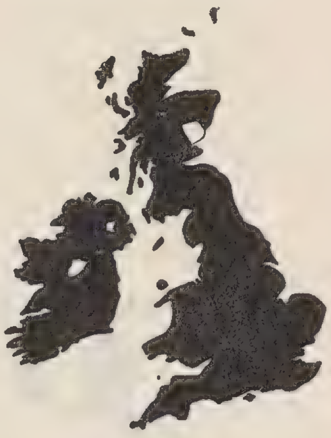
Punctum pygmaeum



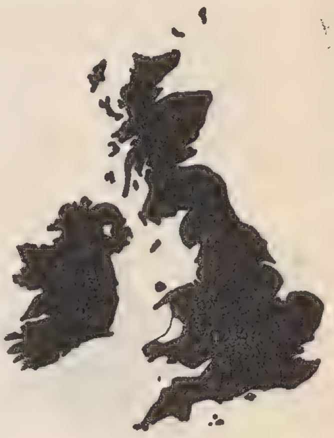
Discus rotundatus



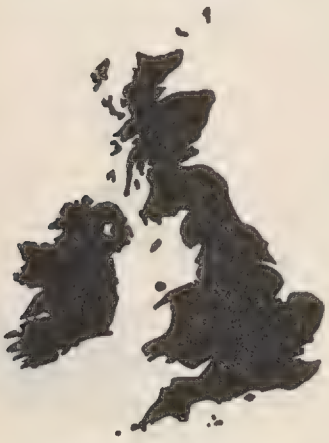
Geomalacus maculosus



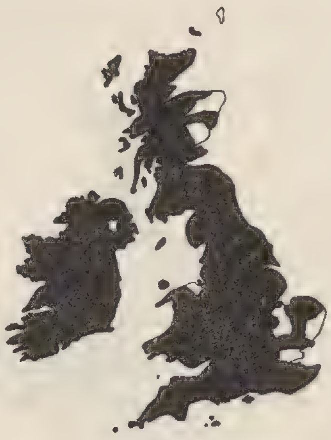
Arion intermedius



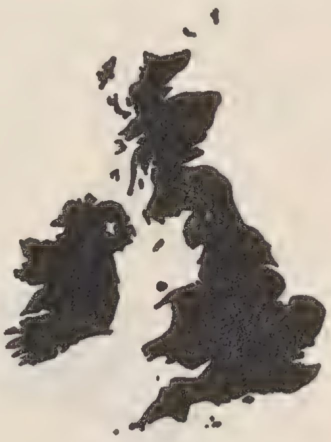
Arion circumscriptus



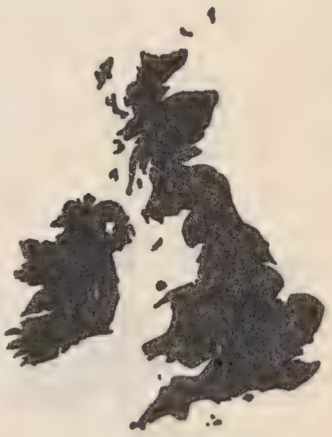
Arion hortensis



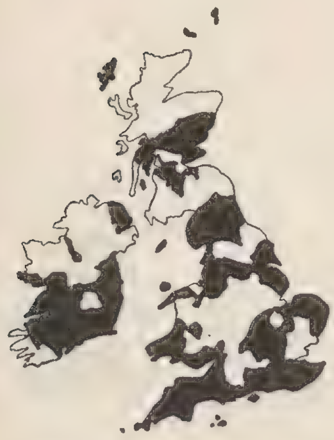
Arion subfuscus



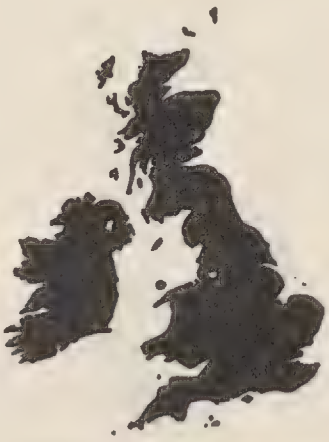
Arion ater *agg.*



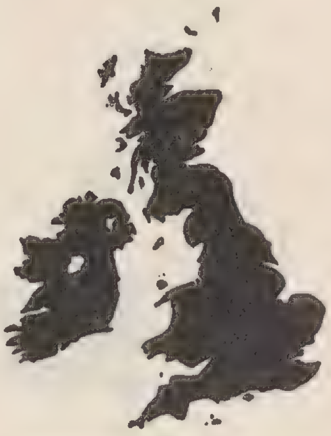
Euconulus fulvus *and* Vitrea crystallina



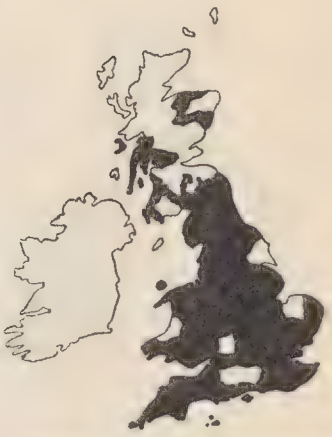
Oxychilus draparnaldi



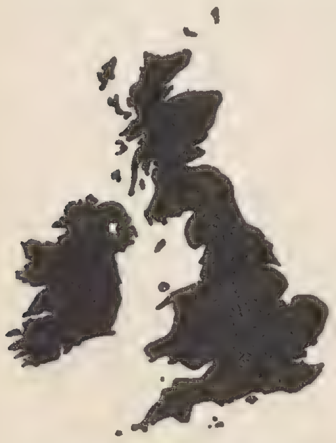
Oxychilus cellarius



Oxychilus alliarius



Oxychilus helveticus



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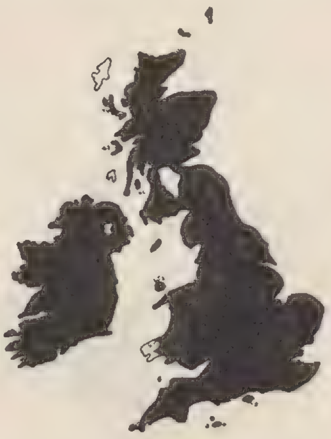
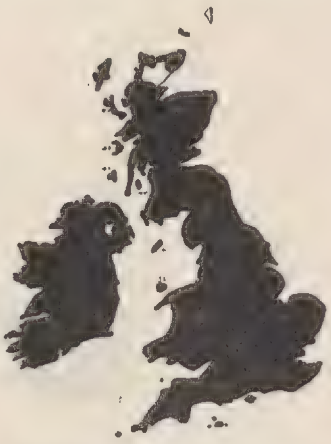
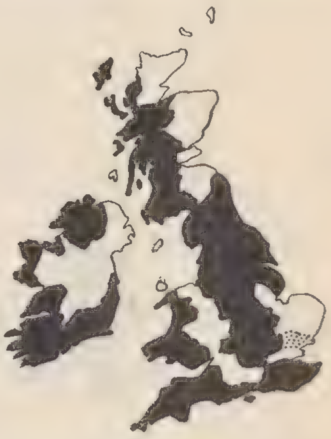


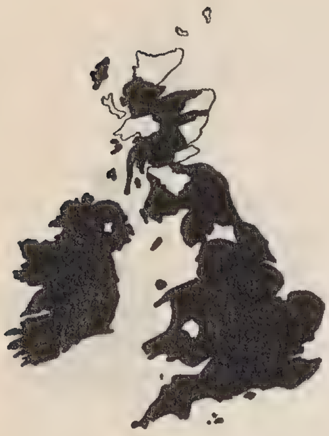
Retinella pura



Retinella nitidula



Zonitoides excavatus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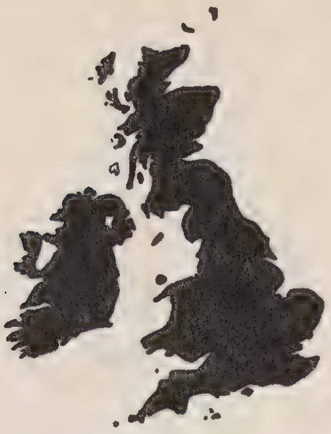
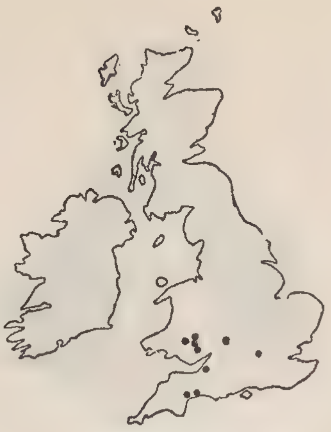
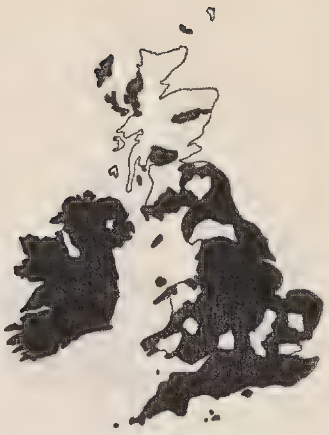
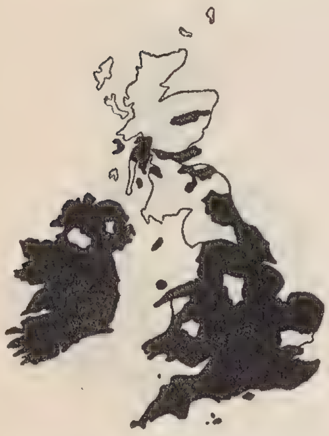

Vitrina pellucida


Vitrina major


Milax gagates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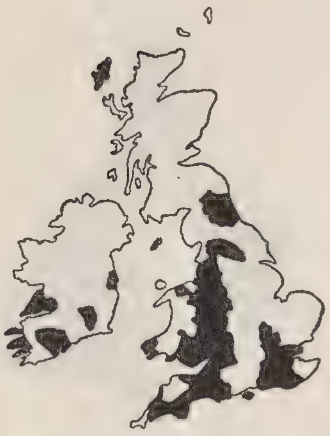
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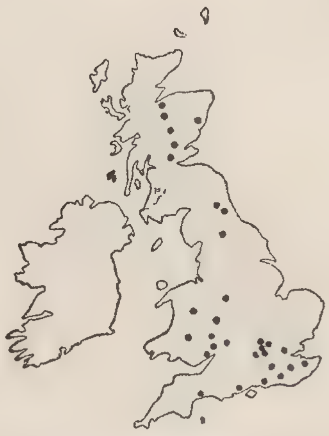
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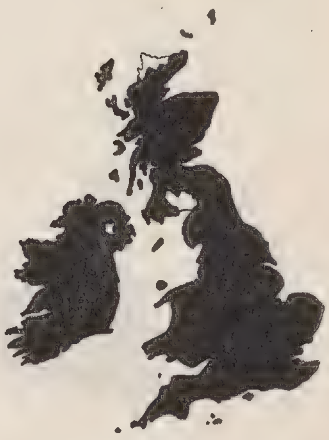
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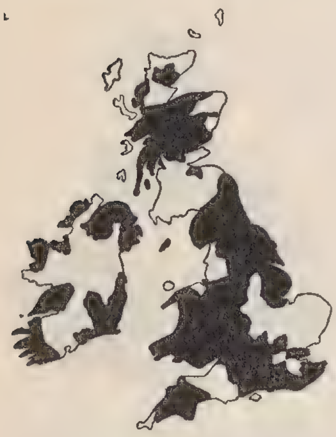
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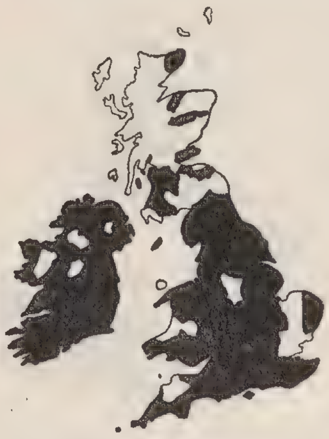
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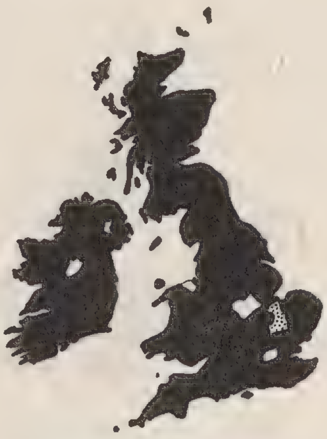
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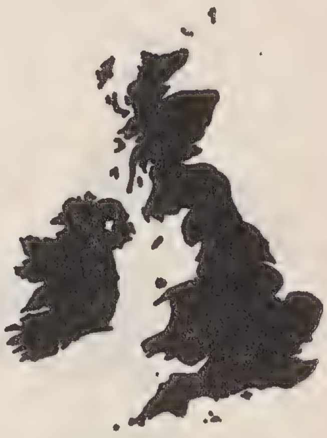
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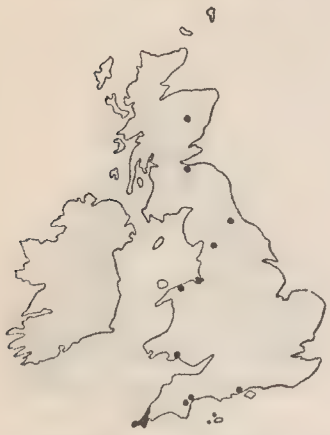
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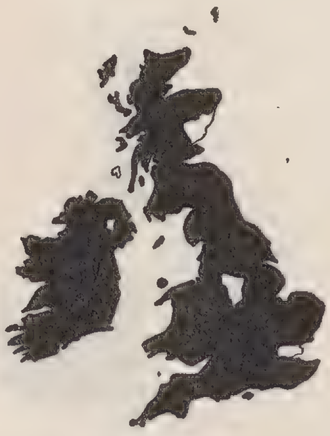
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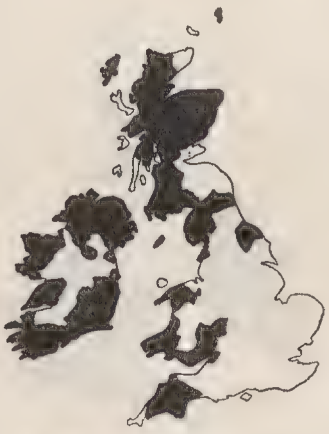
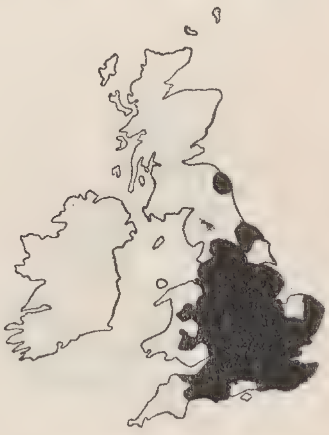
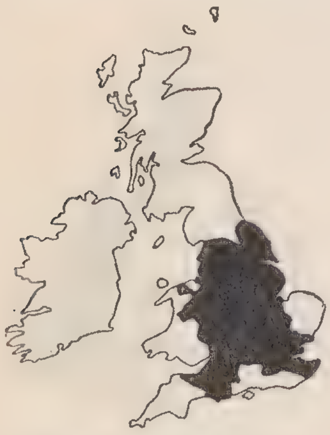

M. margaritifera


Unio pictorum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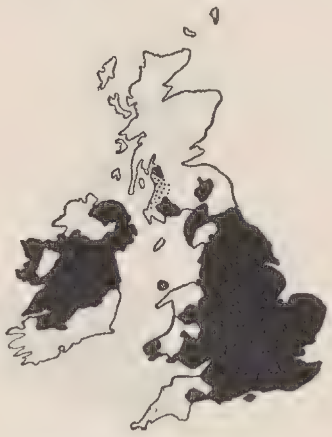
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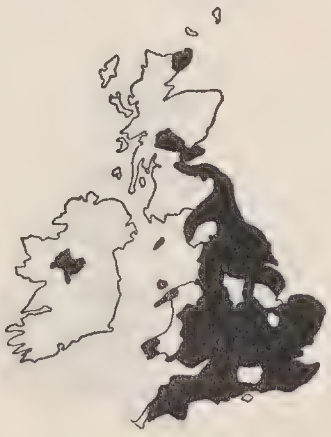
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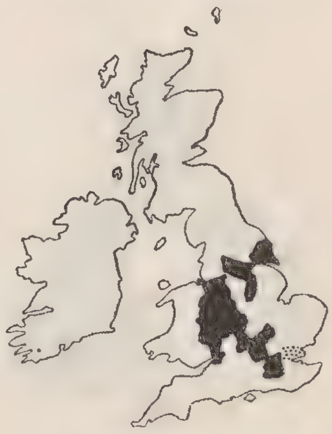
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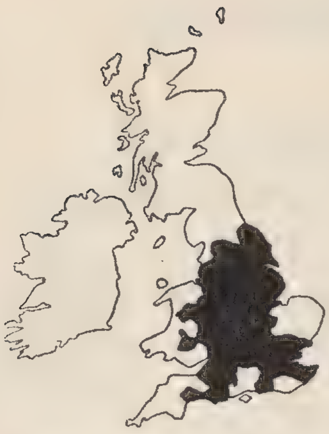
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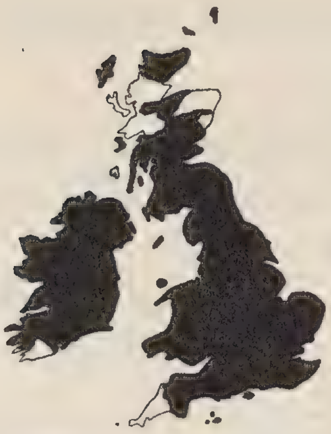
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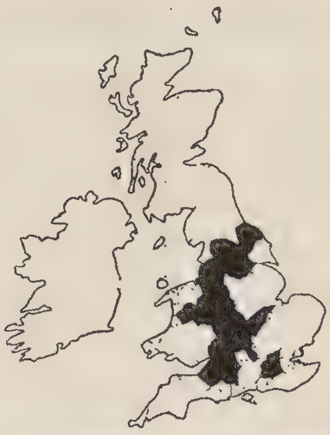
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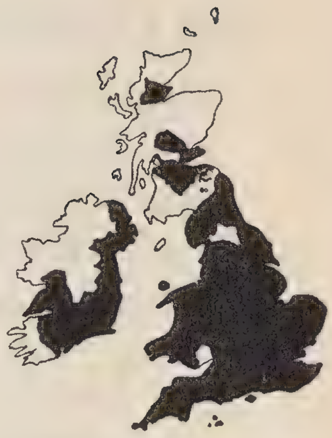
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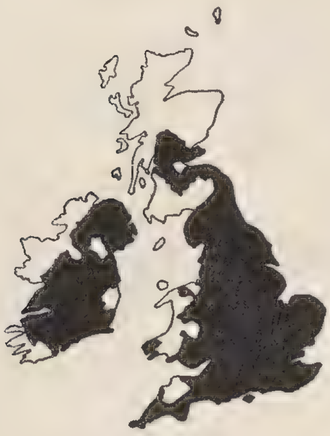
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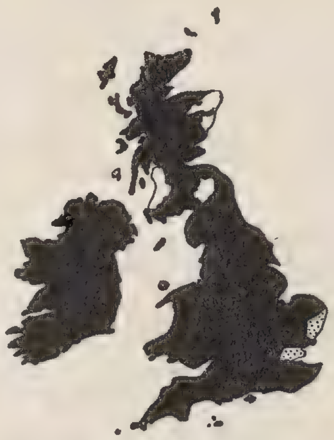
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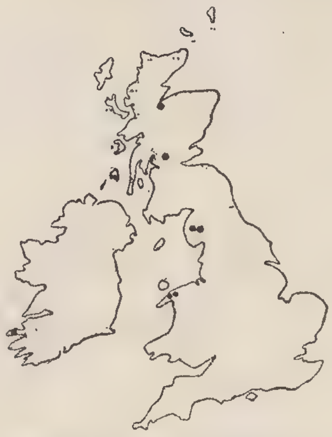
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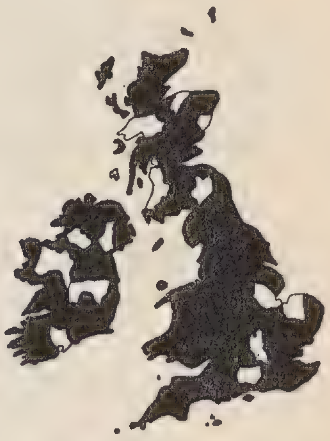
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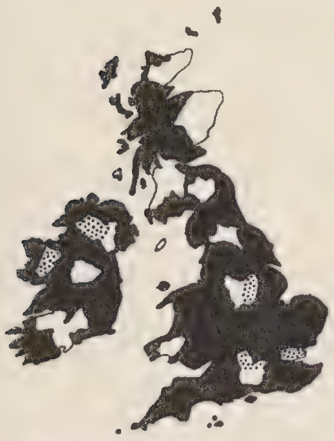
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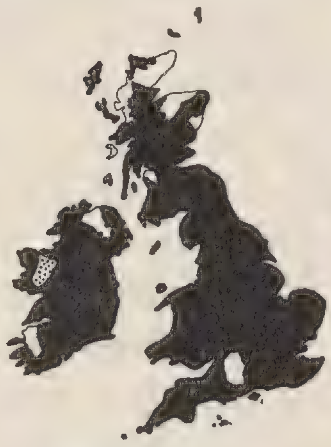
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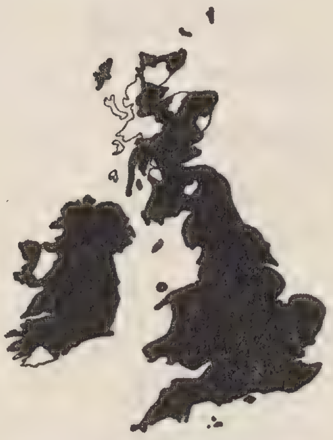
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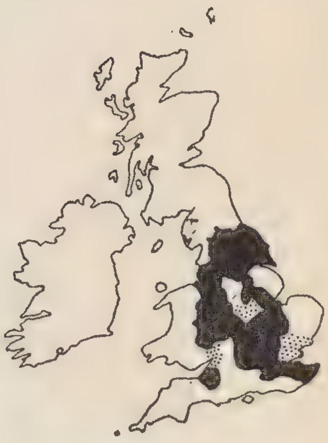
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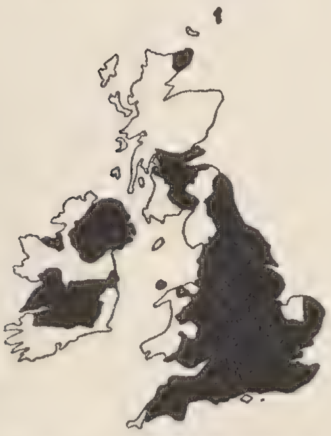
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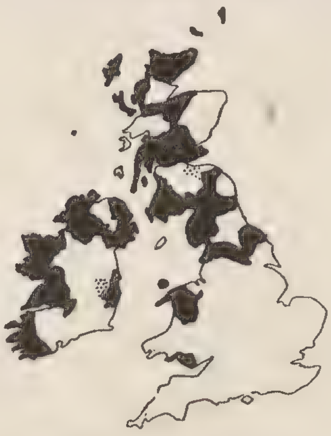
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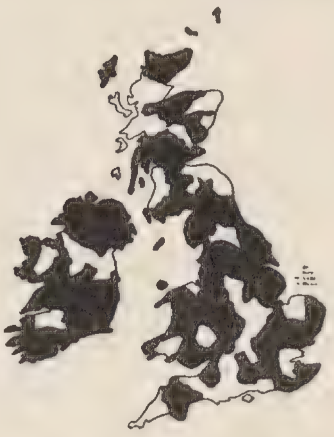
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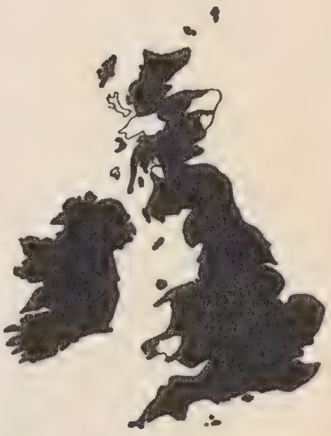
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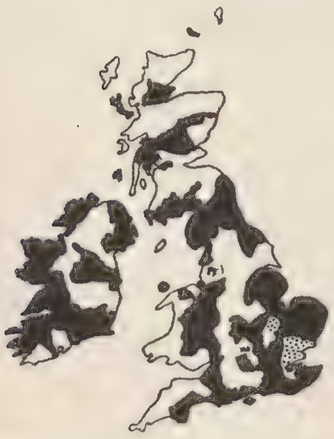
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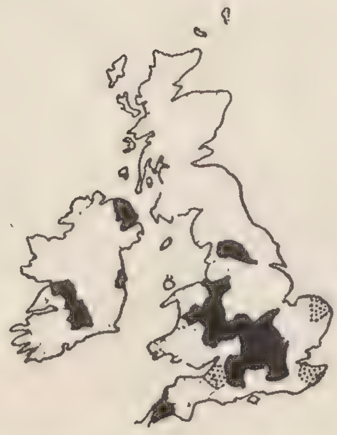
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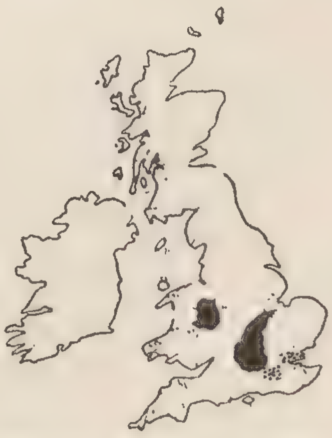
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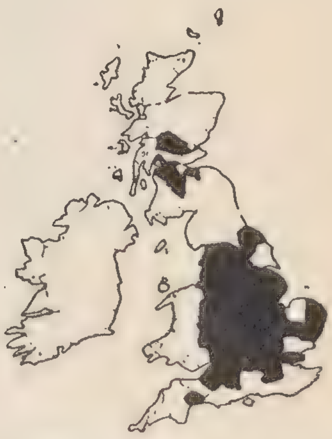
Dreissena polymorpha

EDITIONS OF THE CENSUS OF NON-MARINE MOLLUSCA.

1st edition : 1885, *J. Conchol*, **4,** 319.

2nd edition : 1889, J. W. Williams, *Land and Fresh-water Shells*, 94.

3rd edition : 1896, L. E. Adams, *Collector's Manual of British Land and Freshwater Shells*, 2nd edition, 182.

4th edition : 1901, J. W. Williams, *Land and Fresh-water Shells*, 3rd edition.

5th edition : 1902, *J. Conchol.* **10,** 217.

6th edition : 1921, *J. Conchol.* **16,** 165.

W. D. Roebuck published a " Census of Scottish Land and Freshwater Mollusca ", 1890, *Proc. Roy. Phys. Soc. Edin.* **10,** 437, and separate lists for Easterness, *Scottish Naturalist*, 1916, 107, Argyll, *ibid.*, 229, Wigtown, *ibid.*, 253, Kirkcudbright, *ibid.*, 1917, 7, and Elgin, *ibid.*, 79.

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C. Oldham	1 October 1904.
F. Taylor	12 October 1907.
W. D. Roebuck	14 October 1911.
A. E. Boycott	18 October 1919.
A. R. Waterston	15 October 1938.
A. E. Ellis	21 February 1948.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1950.

Income and Expenditure Account.

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
Paid in 1949 . . .	10	3	0			
For 1950	58	19	0			
Arrears	5	0	0	74	2	0
,, Sales				45	5	0
,, Transfers from Life Membership Fund	22	2	11			
,, Research Fund . . .	11	12	0	33	14	11
				£153	1	11

Cr.

	£	s.	d.	£	s.	d.
By Publication and Distribution—						
Journal, vol. 23, part 3 .	55	5	6			
,, ,, ,, Reprints .	4	17	3			
,, ,, ,, 4 . .	63	8	0			
,, ,, ,, Reprints .	5	15	8	129	6	5
,, Printing and Stationery . .				1	17	7
,, Fire Insurance . . .				1	0	0
,, Zoological Record . . .					8	0
,, ,, ,, Donation .				2	0	0
,, Maps for Census . . .					16	6
,, Cheque Book					4	0
,, Officers' Expenses . . .				8	1	1
Balance, being excess of Income over Expenditure				9	8	4
				£153	1	11

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1950 . .	489	14	0
,, Dividends and Interest	22	2	11
	£511	16	11

	£	s.	d.
By Transfer to Income and Expenditure Account	22	2	11
,, Amount of Fund, 31 December 1950 . .	489	14	0
	£511	16	11

Research Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1950	256	16	0	By Transfer to Income and Expenditure Account	11	12	0
,, Dividends and Interest	11	12	0	,, Amount of Fund, 31 December 1950	256	16	0
	£268	8	0		£268	8	0

BALANCE SHEET.

Liabilities.

	£	s.	d.	£	s.	d.
Annual Subscriptions in Advance				11	3	0
Life Membership Fund				489	14	0
Research Fund				256	16	0
Transfer from Research Fund				100	0	0
Balance, Income and Expenditure Account—						
As on 1 January 1950	290	7	3			
Balance for 1950	9	8	4	299	15	7
				£1,157	8	7

Assets.

	£	s.	d.	£	s.	d.
4% Funding Loan (cost)				350	0	0
2½% Defence Bonds (cost)				200	0	0
3½% War Loan (cost)				40	0	0
Cash at Bankers—						
National Provincial Bank	93	1	8			
Post Office Savings Bank	466	18	11			
Cash in hand	7	8	0	567	8	7
				£1,157	8	7

NOTE.—Assets in addition to those set out in the above Balance Sheet are: (*a*) Library, (*b*) Cabinets and Collections, (*c*) Stock of unsold Publications, (*d*) Annual Subscriptions in arrears.

Audited and found correct.
C. P. CASTELL.
W. J. REES.
14 *February* 1951.

ALBERT E. SALISBURY,
Hon. Treasurer.
10 *February* 1951.

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VOL. 23] 29 FEBRUARY 1952 [No. 8

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SUBSCRIPTIONS became due on 1 January and Members who have not already done so are asked to remit to the Hon. Treasurer without further delay. Those who are in arrears by more than a year cannot expect to receive copies of the *Journal* until their subscription is paid. Members are reminded that the annual subscription is now £1. The mounting cost of printing makes it essential that subscriptions should be promptly paid if the *Journal* is to be published at regular intervals. At present it is financially prohibitive to produce more than two numbers a year. Donations towards the cost of Publication would, of course, be gratefully welcomed by the Hon. Treasurer.

THE
JOURNAL OF CONCHOLOGY

VOL. 23. 29 FEBRUARY, 1952. NO. 8.

THE SHELL COLLECTIONS OF SIR HANS SLOANE, BART. (1660-1753).

With digressions upon the books and people connected with them.

By GUY L. WILKINS.

(*Presidential Address, delivered at the Annual Meeting*, 17 *February* 1951.)

[PLATES 5 AND 6.]

IN the histories of the collections in the British Museum (Natural History) that have appeared from time to time it has usually been stated that none of the shells forming that part of the great collections of Sir Hans Sloane had been traced. Recent work on the older portions of the shell collections in the Department of Zoology during 1950–51 has resulted in the recovery of well over 300 specimens of shells which, in spite of the vicissitudes and changes wrought by the passing of two centuries since Sir Hans Sloane's death, still bear his numbers corresponding with the entries in the three volumes of the manuscript catalogue dealing with the "Testacea".

In some instances the numbers, which were written in ink on small labels attached to the shells, or written on the shells themselves, are remarkably clear considering the long lapse of time, but in others they are so faint as to be almost illegible. It frequently occurs that the ink itself has entirely disappeared, leaving only a slight dulling of the enamel of the shell surface, from which the form of the original figures can sometimes be traced. These ancient specimens are mainly in remarkably good condition, in spite of the rough handling to which they were probably subjected before reaching their final resting place in Sir Hans Sloane's vast collection.

The question is bound to be asked why these historic shells have lain so long unrecognized—a question to which the answer must be simply *replacement*. It was only natural that on the acquisition of collections such as those of Cracherode in 1799 and Broderip in 1837, in pristine condition, many of the rather dull-looking Sloane specimens should have been put away and replaced in the Galleries with fresh ones, for they would prove far more attractive to the public eye than the older, however historic.

Apart from forming the basis of the present National Collection of Mollusca, the Sloane specimens are of interest for their almost intimate association with Linnaeus, Gmelin and Lamarck.

The possibility of claiming any of these specimens as Linnaean or Lamarckian holotypes is ruled out by the fact that both these authors had practically the whole of the shells they described in their own collections at the time of publication of their various works, but they may at least be regarded as type material which would become available in the event of destruction or total loss of the authors' originals.

These great systematists when compiling their works were in the habit of supplementing their sometimes meagre descriptions of species by referring to figures in the few early iconographies which most nearly represented the species they were describing; thus the works of Dr. Martin Lister (1638–1712) and James Petiver (1658–1718) were often quoted in the synonymies given with each description.

William Huddesford, in his 1770 edition of Lister's *Historia Conchyliorum*, published for the first time some manuscript notes made by the author, from which it is clear that Lister was familiar with the large collection belonging to William Courten (1642–1702) and figured several specimens from it. Courten (or Charlton, an assumed name which, for reasons best known to himself, he used for many years) had travelled widely and gathered together, in the words of John Evelyn, who visited him in his rooms in the Middle Temple on 16 December 1868, "such a collection as I had never seene in all my travels abroad, either of private gentlemen or princes."

Both Petiver's and Charlton's collections, the latter estimated by Evelyn to be worth £8,000, ultimately came into the possession of Sloane, and it therefore follows that several of the originals of the figured specimens mentioned by the early systematists were included in the collection acquired by the Nation in 1753.

Although the *Systema* of Linnaeus appeared several years before the completion of the volumes of the catalogue dealing with the "Testacea", no reference to it appears in either of them. This might of itself be natural enough, for even if the work had been generally accepted and circulated by that time, Sloane, who was already seventy-five years of age at the time of the first edition in 1735, would have looked upon it as new-fangled and possibly shunned it for that reason alone.

Another possibility, a very human one, is that the story of the seven-headed serpent in the collection of the celebrated John von Spreckelsen of Hamburg, which the keen-eyed young Linnaeus had examined and rather tactlessly pronounced a fake, had gone before him; at any rate we are told that, when Linnaeus visited Sloane in 1736, soon after this unfortunate diagnosis, the older man gave him a very chilly reception, in spite of the letter of introduction from the great Boerhaave couched in the most glowing terms. It seems obvious from this unsuccessful interview that the eminent Doctor Sloane had no intention of exposing his collection to any of the adverse criticism that had already ruined the reputation of von Spreckelsen.

Hans Sloane was born in 1660, the youngest of the seven sons of well-to-do Scottish parents who had settled in Killyleagh, County Down, where the days of his early youth were spent. The young Hans enjoyed but indifferent health and a long illness at the age of sixteen, from which he only slowly recovered, caused him thereafter to lead an abstemious and simple life at a time when the pleasures of the table were paramount. With returning health and strength it was decided that he should make medicine his profession, and with this end in view he came to London, spending the next four years studying the subjects then thought necessary to become an efficient doctor. In 1683 he went to the Continent to complete his education, later taking the degree of Doctor of Physic at the University of Orange, en route for Montpellier, from whence, after a short stay, he returned to London, setting up practice there in 1684.

According to all accounts Dr. Sloane was successful from the very start of his chosen career, for within two years of starting practice he was appointed physician to the Duke of Albemarle, then about to depart to Jamaica, of which island he had recently been made Governor. Thus for considerably more than a year Sloane was enabled to study the natural history of the island, making copious notes and gathering together a large collection, which later served as the basis for his two important works, the *Catalogue of Jamaica Plants*, 1696, and the *Natural History of Jamaica*, the latter a lavish work in two volumes, the first of which appeared in 1707 and the second in 1725. John Evelyn appears to have urged Sloane to carry out this literary work when he called to inspect the Jamaica collection and "Journal of Observations" on 16 April 1691. In his opinion they were "sufficient to furnish a history of that island, to which I encourag'd him". The long interval between the publication of these two volumes was probably due to the great labour of arranging the collections made during his stay in Jamaica and to incorporating the collections of Charlton, "bequeathed" to him in 1702, and that of James Petiver, which he purchased in 1718 for the sum of £4,000. The latter collection was apparently in great confusion, and caused its new owner no little trouble and anxiety in arranging it to his taste.

Sloane's public and professional life at this time was a very busy, if lucrative, one; among other appointments he held at various times were those of First Physician to Queen Anne and later to George I (by whom he was made a Baronet in 1716); Physician General to the Army; President of the Royal College of Surgeons; Secretary and later President of the Royal Society. Such a position of wealth and influence encouraged people with all kinds of natural curiosities to approach him with a view to their disposal, and a glance at a list of the total numbers of objects comprising the collection, of which the shells alone, recent and fossil, amounted to over 5,000 specimens, leaves one with the impression that few of the vendors failed to conclude a satisfactory bargain. Sir Hans Sloane has been accused of being rapacious and indiscriminating in his collecting and to have possessed an almost childlike credulity, but it is only the cynic who would mistake extreme enthusiasm for rapacity, and there is little reason to suppose him to be more credulous than his contemporaries, who frequently condemned witches to be burnt at the stake and retained the witchcraft laws in force for many a long year. For an "indiscriminate" collector Sloane seems to have chosen the collections he purchased remarkably well, for included among them were the important ones of Plunkenet, Kaempfer, Buddle and Merret, in addition to those of Charlton and Petiver already mentioned. Apart from outright purchases of entire collections he was always ready to assist travellers with their expenses in order to acquire localized material, and with this purpose he financially assisted Mark Catesby (1679–1749) to make his journey to Carolina in 1722. It must not be imagined from this that Sloane helped only when some personal advantage was to be gained, for he gave at least £100 to nearly every hospital in London and more at his death. None who applied to him in sickness or distress was turned away, and even after his retirement from practice and public life at the age of 82 his house was always open to any who wished to consult him.

George Edwards, F.R.S., author of the *Gleanings of Natural History*, frequently visited the ageing physician at this time, to drink coffee and convey the news of the Town, and in the second volume of his work, which Sloane had materially helped him to produce, Edwards pays tribute to his old friend and patron, shedding an interesting sidelight on his unassuming generosity. Knowing that he (Edwards) was not too well endowed by fortune, arrangements were made for the expenses incurred by the weekly visits to Chelsea to be defrayed annually from his own purse, thus avoiding any embarrassment during the visits. Sir Hans Sloane died on 11 January 1753 at the great age of 93 years, and was buried in the graveyard of old Chelsea Church. Edwards was present at the time of his death and has described the three days' illness which terminated this long and busy life.

Opinions are divided as to how far Sloane's personal charm of manner and conversation contributed to his success as a doctor. In the realms of science he achieved little that was new, and could never be said to have attained anything like the eminence of his predecessor, Sir Isaac Newton, as President of the Royal Society, yet he held that office for a period of 13 years (1727–1740). It is therefore as a collector that Sloane holds attention, and it is in this field that he may be said, with truth, to have attained unrivalled eminence. At the time of his death the collection, excluding books, of which there were 50,000, amounted to no less than 100,000 items, mostly catalogued by himself, assistance in this task being given by several friends only in his declining years. Edwards, in the preface to the *Gleanings of Natural History*, gives a detailed list of the numbers of specimens under appropriate headings, stating that " every single particular of all the above articles are numbered and entered by name, with short accounts of them, in thirty-eight volumes folio and eight in quarto ".

It is uncertain at what date the " Testacea " catalogues were started, but it must have been well before 1728, for a summary of fossil shells in the collection is given at the back of volume three, made up to mid-October 1728, at which time that part of the collection alone numbered 1,757 specimens. There is more certainty about the completion of the catalogues, for the third entry from the last, No. 5843, was the gift of a fossil *Anomia* from Emmanuel Mendes da Costa (1717–91) and is fortunately dated 17 September 1747. This is an exception to the rule and is one of the few, if not the only entry to be dated. No. 5846 completes the three catalogues of " Testacea " or shells, the word " end " being written underneath in the same hand that had made the last hundred or so entries—in all probability that of James Empson, Sloane's curator and the first curator of the British Museum (d. 1765). The number of recent and fossil shells is usually stated to have been 5,846 according to the catalogue numbers, but in actual fact there were many more than that, because of multiple entries under one catalogue number.

Many interesting details emerge from a perusal of these records, but space will only allow a quick review of some of the friends and acquaintances of Sir Hans Sloane who sent or brought shells from all parts of the then known world to Southampton Street and later to the great house at Chelsea.

One of the most frequently mentioned names is that of the erstwhile Physician to the Dutch East India Company, Doctor Engelbert Kaempfer (1651–1716), who voyaged to Japan in that capacity between the years 1690 and 1692. His experiences of the country, its peoples and particularly its natural history were all carefully recorded with a view to publishing an extensive History on his return, but exacting service to his Sovereign Prince, the Count de Lippe, and his own frequent illness prevented the completion of this plan before his death, which occurred in 1716. Having heard of Kaempfer's demise Sloane requested his own colleague, Doctor Steigerthal (Personal Physician to George I) to make inquiries as to the fate of the collection during one of his frequent trips to Hanover in attendance on that Monarch. This Steigerthal did, with the result that the whole collection of shells, plants and manuscripts came over to England. Among the manuscripts Sloane found the nearly completed *History of Japan*, and he wasted no time in publishing the results of the Dutch physician's investigations at his own expense. J. G. Scheuchzer, F.R.S., was employed to translate the original High Dutch manuscript into English, Sloane placing his own extensive library at the disposal of the translator while the work was in progress. This handsome work, in two volumes, with illustrations from Japanese designs, appeared in 1727 and contained a great deal of information never before made public. The shells were described on pages 139 to 141 and lively representations of living Cephalopods and various bivalves were included among the plates. It may be of interest to note that it was one of Kaempfer's shells, bearing the number 1797 (at first thought to be a date) and the word "Japan", that led to the present investigation and subsequent tracing of so many original Sloane specimens.

Mark Catesby, whose name often appears in the catalogues, has already been mentioned regarding his journey to Carolina in 1722, and it was largely through the generosity of his patron that he was enabled to settle there for the space of two years, collecting material for his *Natural History of Carolina, Florida and the Bahama Islands*; this appeared in two volumes, with numerous very fine coloured plates, in 1731 and 1743. During his stay in Carolina Catesby sent many specimens of shells to swell the Sloane collection. In the preface to volume 1 of his work (pp. v and vi) Catesby acknowledges the help given him by Sloane in the following words: "Both in Carolina and on these Islands (those adjacent to the Bahamas) I made successive collections of dried plants and seeds, and at these Islands more particularly I collected many Submarine productions, as Shells, Corallines, *Frutices Marini*, Sponges, Astroites, &c. These I imparted to my curious friends, more particularly (as I had greatest obligations) to that great Naturalist and Promoter of Science *Sir Hans Sloane*, Bart. to whose goodness I attribute much of the success I had in the undertaking."

Shells collected by William Dampier (1652–1715) during his second circumnavigation are also included in the collection ; whether these were obtained directly from him is uncertain, but it is well known that this intrepid explorer and pirate paid much attention to the natural history of the countries he visited.

The name of John Bartram the Quaker (1701–1777) of Philadelphia, one of the earliest and perhaps best practical naturalists of the New World, appears from time to time in the catalogues. Through his friendship with Peter Collinson (1694–1768), another Quaker, he corresponded with and sent specimens to most of the wealthy and industrious circle of naturalists of the period. Apart from Peter Collinson and Sloane this circle of correspondents included Linnaeus himself (who termed Bartram "the greatest *natural* botanist in the world") ; the Dukes of Norfolk, Argyll and Richmond ; the famous collector of shells, the Duchess of Portland ; Lord Petre and Doctors Dillenius and Gronovius. Towards the end of the third volume of the Sloane catalogue an entry occurs which shows Bartram to have been a good observer of living things, for he evidently sent over some specimens of a bivalve referred to as a *Solen* from Philadelphia, accompanied by a note of their behaviour when alive. This note was copied in under entry No. 5766 and reads as follows :—

> 5766 "The crooked small solen. These are a remarkable species of the clams . . . when anybody approaches them they spout a stream of water up (by which we know where to find them) then retire directly about a foot deep in ye sandy shore where the tide leaves them about half ebb in ye sound by the beach they are surprising nimble they will extend themselves out of the shell near the length of it nay I have seen them skip about their holes in a pudle of water as nimble as a fish but upon walking towards them gives them notice of aproaching danger what I relate here is fact tho' I could hardly believe it if I had not seen it myself, from Dr. Bartram."

These observations were probably made on the shores of Delaware Bay and may refer to *Ensis ensis* (L.) ; the actual specimens, if still in existence, have not yet been traced.

James Petiver (1658–1718), the friend and contemporary of Sir Hans Sloane, has already been mentioned, but more needs to be told of one so intimately connected with the collection as a whole. Petiver was a wealthy apothecary who endeavoured to make his collection as complete as possible. It contained natural objects of all kinds, many being described in his various contributions to the early volumes of the *Philosophical Transactions* (Journal of the Royal Society) which, incidentally, Sloane did much to revive during his long term of office as secretary. These contributions show Petiver to have been something more than a mere collector of curios, for they deal with specimens received from definite localities, many of which had seldom been visited for the purpose of making even incomplete faunal lists. John Ray, in a letter to Edward Lhwyd dated 30 April 1701, wrote that Mr. Petiver " hath the greatest correspondence both in East and West Indies of any man in Europe; I think I may say, than all *Europe* besides ". Several papers on shells appeared in volumes 20, 21, 23 and 27 (1698–1712), and were descriptive of specimens brought from the Moluccas, the Island of Ascension, Carolina and Maryland. In addition to these literary efforts Petiver conducted and contributed to the *Monthly Miscellany or Memoirs for the Curious*, three numbers of which appeared between 1707 and 1709. The principal article to appear by the compiler was an account of some bivalves brought from the coast of India by " divers curious persons " ; frequent reference to these specimens is made in the Sloane catalogues.

Petiver's real *magnum opus*, however, was the *Gazophylacium Naturae et Artis*, commenced in 1702 and intended mainly for the publication of engravings of the many rarities contained in his collection. There were altogether 100 plates of engravings in the original two-volume work, accompanied by lists giving short descriptions of the objects illustrated together with their localities. The work was divided into " decads ", which could be purchased separately, with or without plates, at a very moderate cost. A footnote to one of the parts states that " such as buy 5 of each to have a 6th gratis ". The figures are placed in no particular order, plants, mammals, birds and shells appearing together on the same plate, except that they usually have the same country of origin. One of the most important parts of the work is the *Pterigraphia Americana*, illustrating in twenty plates the plants and animals of the " Charibbee " (Windward) Islands, and must be some of the earliest localized records to be published from this group of islands. The figures of shells are, on the whole, rather poorly engraved, but can usually be recognized from the originals of which several, marked by both Petiver and Sloane, have already been recovered. The latter added many references to Petiver specimens in his catalogues, using the phrase " designed by Mr. Petiver for his Gaz. Nat.", followed by a capital "P" after entries and on actual specimens. The frequent occurrence of this marking gives some idea of the large number of shells in the collection at the time of its acquisition by Sloane in 1718, the year of Petiver's death.

Maton and Rackett (p. 148), while deploring the lack of " even an outline of scientific order ", evidently felt bound to admit that " . . . from its having been so frequently referred to by Linnaeus ; as long as whose writings are consulted, the Gazophylacium of Petiver must remain in repute ". Petiver was nearly as active as Sloane in his efforts to encourage travellers to obtain specimens for his collection and went to the trouble of preparing and circulating a sheet of instructions addressed to persons going abroad on the methods to be employed in the preservation of specimens for shipment. After explaining that soft bodied animals can be preserved in " Rack, Rum or Brandy ", he goes on to say,

> " All Gulph-weeds, Sea-mosses, Coralls, Sea Feathers, Spunges &c. may be put together into any old box or Barrel with the shrimps, Prauns, Crabs &c. which you will often find amongst the seaweed, or on the Shoar with the Shells, which you may place in layers ; as we do a Barrel of Colchester Oysters.

All SHELLS may be thus sent as you find them, with or without the snails in them, and wherever you meet with different sizes of the same sort pray gather the fairest of all magnitudes ; the Sea Shells will be very acceptible, yet the Land and Freshwater ones, are the most rare and desirable. . . ."

(the directions are signed)
Yr most Humble Servant
JAMES PETIVER

Aldersgate Street
London.

Many other names scattered through the records would repay investigation, but the few additional ones that it is possible to mention here will serve to indicate some of the localities from which specimens were obtained. Thus, Mr. Campbell is found to have sent shells from Jamaica, Mr. Cunningham from China, Mr. Fawcett from Fort St. George, John Salvador from Barcelona, Mr. Hyde from Maryland, Doctor Waldo from Surat and Father Kamel (or Camelli) from the Philippines. A fitting entry to close this short account of personalities is one contained in the last page of the catalogue, No. 5820, which records the gift of a pearl from Sir Robert Walpole (1676–1745), in whose family it had been a valued possession for many years.

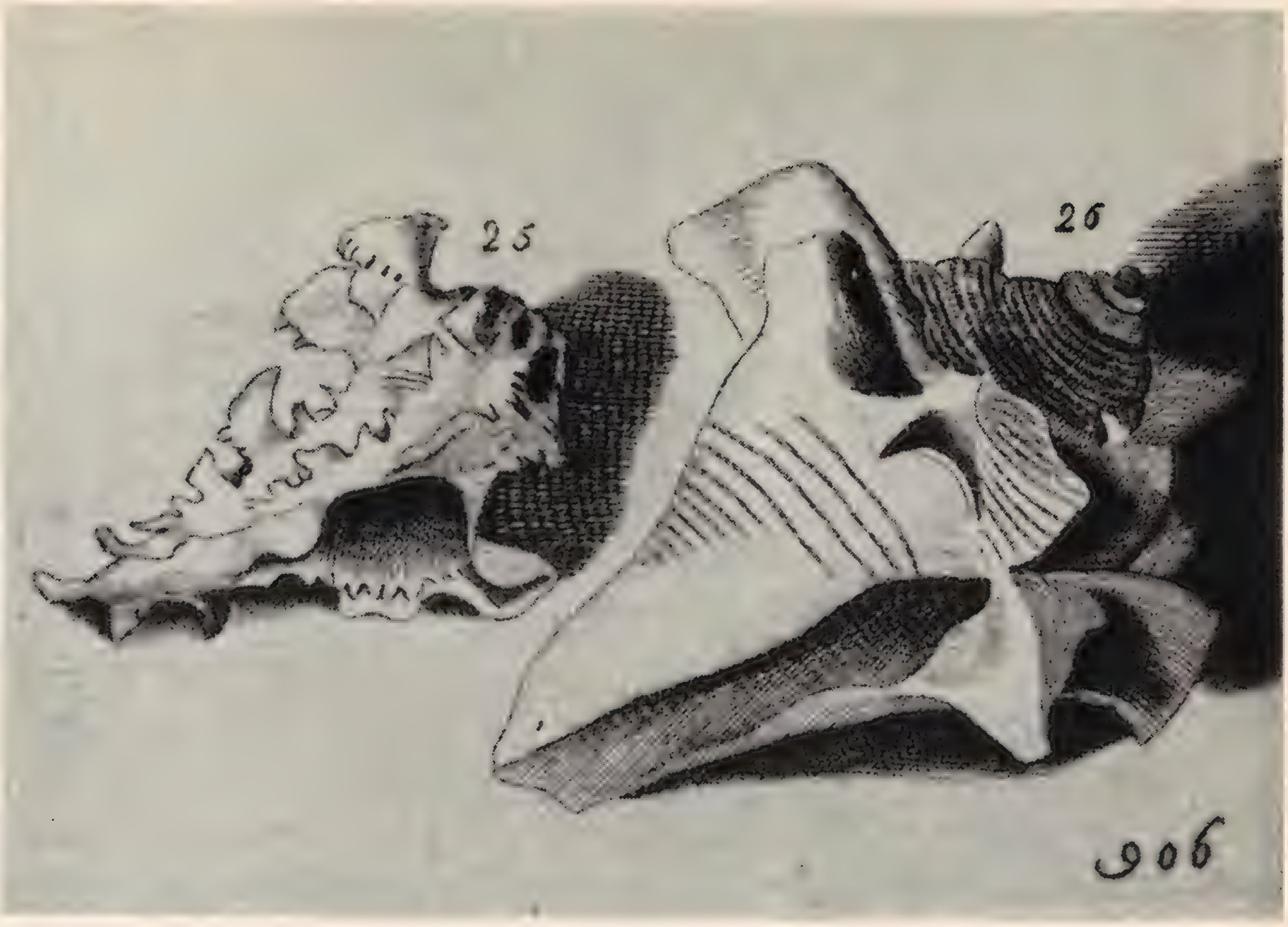
It will be necessary, before describing some of the actual shells, to say a few words about identification, which in some instances is extremely difficult. It will be appreciated that the entries were made before the days of binominal nomenclature, so that the specimens are all described by means of Latin descriptions based on the older authors. Fortunately Sloane worked with Martin Lister's great work before him, thus by far the larger number of entries are described in Lister's words with a reference to his plate and figure numbers ; this forms an invaluable check as to whether a much faded number has been correctly deciphered. To Lister's descriptions Sloane would add Latin words of his own or lapse into very homely English. A typical example of this kind of entry is one that completes a Latin description with the words " the same as 1107 but more knubby ". Many of the entries, made when only one specimen was in the collection, were added to, sometimes very hurriedly, as fresh ones were acquired, new additions being separated from the previous by an oblique line. It may be of interest, in default of a photographic reproduction, to give a transcript of one of these complicated multiple entries which has been selected as fairly representative of its kind :—

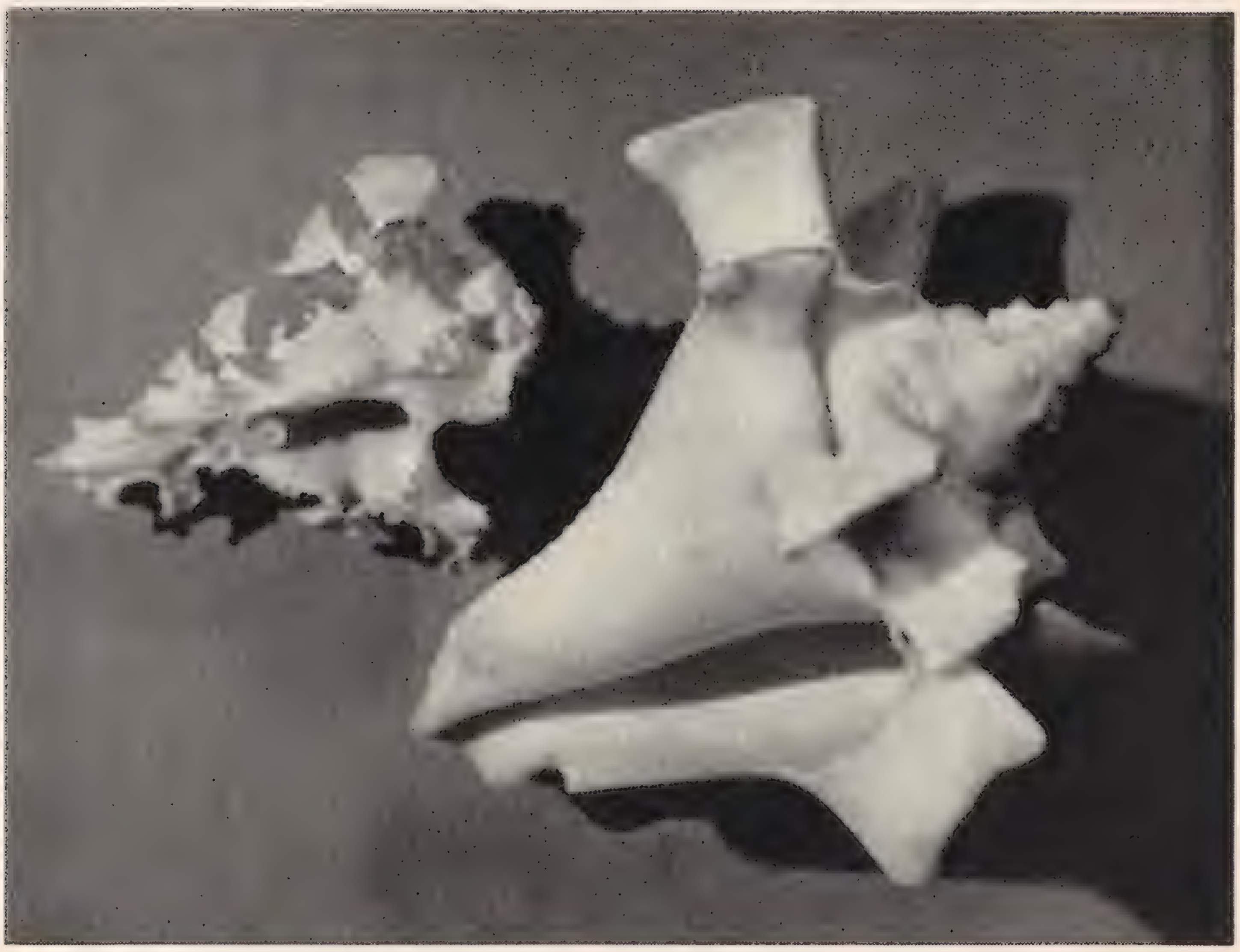
1482. Buccinum rostratum, grande, raris lineis circumdatum, laeve non, nisi ima parte cujusq orbis striata. List. Hist. tab 911 No. 2/more or less white/ thinner and browner/from Jamaica/ From Messisipi. P./considerably larger than that figured by Lister.

The space allotted to the entry being full, a further acquisition to No. 1482 is entered on the left hand (blank) page as under :—

> Buccinum Jam. fasciatum tenue/From Bahama Islands. Catesby/from Jamaica pretty large and a little distorted. by Mr. Campbell.

This particular entry refers to nine specimens of *Fasciolaria tulipa* (L.), several of which have been traced. The preceding entry, 1481, proves to be the original of Lister's plate 910, fig. 1, which depicts the shell now





[*British Museum Photograph.*]

Strombus pugilis and *Murex rota*: Lister's figures and Sloane specimens.

known as *Fasciolaria distans* Lamarck and was evidently considered as a variant of *tulipa* at that time. This shell stands in close relationship to Lamarck's type, as it is the only figure mentioned when the species was described in the *Animaux sans Vertèbres*, 1822 (7, 119).

Not the least interesting of the several shells to be described in detail is an immature monstrosity of *Strombus pugilis* L., in which the spines are flattened and paddle-shaped. It was first figured by Lister in the *Historia Conchyliorum*, 1688 (plate 906, fig. 26), without any description. The Sloane number on the shell is too faint to be correctly deciphered, but it must have come from the collection of William Courten from which, as already stated, Lister illustrated many specimens. Reference to this figure heads the synonymy given by Linnaeus when describing the species in the 10th edition of the *Systema* (*Strombus*- sp. 430, p. 744).

The reason for quoting this figure of a deformity without comment is curious, particularly as the other examples given are normal representations of the shell generally accepted by authors for *Strombus pugilis* L. According to Hanley (p. 269) the shell marked for the species in the Linnaean cabinet is of the accepted form. One explanation might be that the name was first applied to Lister's figure, normal forms only coming to the author's notice later. The shell certainly gives the impression of a number of protruding fists, to which the name *pugilis* would apply admirably. In the 13th (Gmelin) edition of the *Systema* (1788–91) Lister's plate 906, f. 26, has been supplanted by a reference to plate 864, f. 19, a figure apparently copied from Aldrovandus which might only with charity be supposed to represent some form of *S. pugilis*. This plate 906 contains another figure in addition to the *Strombus*; this is an immature specimen of *Murex* (*Homalocantha*) *rota* Mawe, which is still in existence, and although the Sloane number is too faint to be deciphered, there is little doubt that the shell is the original of figure 25 on the plate. These two shells have been photographed and reproduced in a position as near as possible to those on the plate drawn by Susanna Lister in 1688.

The whole of the 1,050 plates in their father's monumental *Historia Conchyliorum* were produced by his two daughters Susanna and Anna Lister between the years 1685 and 1692. The work is generally of a high standard of execution and accuracy and displays to advantage the individual styles adopted by each artist. Anna used a broad, open series of graduated lines, a treatment considered extremely "modern" at the present time; Susanna kept her lines thinner and made use of a certain amount of cross-hatching in the cast shadows. These two styles are constant throughout the work, changing only when figures in an unfamiliar style had to be copied from other authors; work on these historic specimens has on several occasions been greatly assisted by the care bestowed upon the engravings. A case in point is a specimen of *Voluta scapha* Gmelin, which had every appearance of an ancient specimen but no trace of a number to prove it; later comparison with Lister's plate 799, fig. 6, showed it to be the original of the engraving, with which it agrees in every detail of form and marking, thus proving it to be the shell referred to by Gmelin in his synonymy when describing the species in 1790 (p. 3468). Posterity cannot help but agree with the sentiments expressed by Maton and Rackett (p. 141) to the effect that Susanna and Anna Lister's names " deserve to descend to posterity with their father's and whose meritorious industry and ingenuity are patterns for their sex ".

Doctor W. E. Leach was one of the first systematic workers to describe and figure some of the Sloane shells during his term of service as Assistant Keeper (1813 to 1821) in the old " Department of Natural History and Modern Curiosities ". During part of this time, to use the bitter words of Swainson (p. 335), Leach was engaged in " cleaning out what was then an Augean stable"—a chaos of " confusion worse confounded ", and although this may sound, and probably was, an overstatement of the facts (Swainson had tried more than once and failed to obtain an appointment on the staff of the Museum), it is known that during Leach's time periodic bonfires were made which must have included many Sloane specimens, a drastic method of tidying up necessitated by the decay of birds and other animals imperfectly preserved by the older naturalists. It might be imagined that the Herculean task of getting his department into order would leave Dr. Leach little time for actual scientific work, but, on the contrary, a great deal of writing was done during the period 1813–1821, which included the *Zoological Miscellany* published between 1814 and 1817. Three volumes appeared, fully illustrated with coloured plates drawn by Nodder, most of which were from specimens in the British Museum. As with other miscellanies of the period, each volume contained, beside quadrupeds, birds and insects, several plates of shells, the specimens being chosen either for their newness to science or for their rarity. Leach's specimens of shells, several of which he described as new, were selected from those of Sloane and Cracherode, which together formed practically the whole of the National Collection at that time. Three of these type specimens have been traced back to the Sloane collection, and will be described as briefly as possible.

The peculiar growth of the specimen of *Strombus pugilis* already dealt with above led Leach to give it specific status under the name *Strombus Sloanii* and to figure and publish it as such in volume 3 of the *Miscellany* (plate 22). Although most authors, commencing with Dillwyn in 1817, have deplored the designation of the species as erroneous, Leach's description and figure have at least helped to confirm, in view of the missing catalogue number, that this shell is an authentic Sloane specimen.

In the same volume (plate 53) Leach also figured and described his new sub-genus and species of *Anodonta*, namely *Dipsas plicatus*, the type specimen of which lays claim to previous notoriety. This shell was one of the first Sloane specimens to be figured as the property of the British Museum, and appeared on plate 2 of John and Andrew van Rymsdyk's *Museum Britannicum*, published in folio with 32 plates in 1778 ; a second edition by Boyle followed in 1791. The figure gives an excellent representation of the left valve of the shell, in the centre of which is a nest of six artificially produced pearls. The right valve, which is not figured in this instance, has a widely spaced row of four similar pearls. There were originally fourteen, eight on the left valve and six on the right, two spaces being visible on each valve where the pearls had been removed or fallen off prior to 1778. It is stated by the authors, and repeated by Leach, that the shell is a "Bohemian River Horse Muscle with six pearls sticking to it", but Bohemia as the locality is obviously incorrect; *Dipsas plicatus* is an Asiatic species occurring in the rivers of China and Japan, where it has been used for the cultivation of pearls for many centuries. No doubt the Sloane number was missing in 1778 as it is to-day, in which case it would have been an easy matter to confuse it with several specimens noted as having pearls "sticking to them". Although it is known that culture pearls were produced in the rivers of Bohemia, there is no evidence that an Asiatic species has ever been imported and established for this purpose. In Leach's figure both valves of the shell are shown in juxtaposition but a little distance apart, exhibiting the hinge characters and two of the pearls in the right valve. Several fragments of *D. plicatus* with attached pearls, mentioned in the original description, are still in existence.

Two pages in the Sloane catalogues are devoted to shells from the Straits of Magellan, sent by a Mr. Handisyde, and there is little doubt the *Voluta subnodosa* Leach is one of these. The figure given in volume 1 of the *Miscellany* (plate 8) is poor, but sufficiently accurate for the specimen to be recognized. In his description the author stated that one other example was known to him, which had been loaned for comparison by Mr. Bullock, the proprietor of the London Museum. This collection was sold by public auction during 1819, but the whereabouts of this possible paratype is unknown.

The only other Sloane type named by Leach to be recovered so far is *Loligo sloanii*, which was described in manuscript and eventually published by Dr. J. E. Gray as *Sepioteuthis sloanii* in 1849. The dry gladius, removed by Leach himself, and the animal in spirit are still extant. This species was included in Gray's *Catalogue of the Mollusca Collections in the British Museum*, Part 1, *Cephalopoda*, where he described another species from the Sloane collection, namely *Ommastrephes sloanii* (p. 61), but of this only some fragments of dried gladius remain. Gray described at least one other species from the collection and this type has also been recovered—*Solen sloanii* from Pegu in Lower Burma. There is little doubt that several more type specimens will eventually be recovered, particularly among the older spirit material, but changing of spirit and the deterioration of labels in the past make identifications extremely difficult.

Space permits only brief mention of the few remaining specimens of aesthetic value which graced the Sloane collection, such as, for example, the three beautifully carved *Nautili*, one of which depicts Admiral van Tromp in full armour surrounded by his fleet, the portrait head in high relief with the rest of the design engraved and blacked-in to form a contrast; another Nautilus is carved with graceful acanthus ornament enclosing medallions engraved with bacchanalian scenes, while the third, although more crudely carved, bears the date 1693.

It is small wonder that these, together with carved chank shells brought from Japan by Dr. Kaempfer, gloves woven from the silky byssus of

Pinna and presented to Sloane by the Duke of Richmond, a pearl pendant in the form of a bunch of grapes with gilt and enamel leaves, should call forth the admiration of contemporary visitors to the museum of the famous "Jamaica Doctor". Much has been and could still be written about the collections and personality of this great eighteenth century figure; the weekly dinner parties attended by most of the notable doctors and men of science of the day; the sometimes stormy meetings at the Royal Society; his kindness to absent friends such as John Ray, to whom presents of sugar and sometimes venison were sent to cheer the sickness of his declining years. All these and many other scraps of information add flavour and background to the approaching bicentenary of that doyen of collectors, Sir Hans Sloane, Bart.

A SHORT SUMMARY OF THE SPECIMENS NOW AVAILABLE IN THE SLOANE SHELL COLLECTION.

Three hundred and ninety specimens have now been segregated, checked and labelled with the corresponding Sloane numbers and locality data extracted from the three volumes of the "Testacea" catalogues. Over thirty of these specimens have been found to be the originals of figures given by Martin Lister in his *Historia Conchyliorum*, published between the years 1685 and 1693. Fourteen specimens are the originals of the figures given by James Petiver in the *Gazophylacium Naturae*, 1702–1711. Eighteen of these figured specimens are the originals of those referred to by Linnaeus, Gmelin and Lamarck in their synonymies. Three further specimens are the originals of figures appearing in J. and A. van Rymsdyk's *Museum Britannicum*, 1778. Five type specimens described by W. E. Leach and J. E. Gray are also included in the collection.

ACKNOWLEDGMENTS.

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BIBLIOGRAPHY.

LISTER, M., 1685–92. *Historia sive Synopsis methodica Conchyliorum*, fol.

—— 1770. *Historia sive Synopsis methodica Conchyliorum et Tabularum Anatomicarum*. Editio altera. W. Huddesford.

PETIVER, J., 1702–11. *Gazophylacium Naturae et Artis*. 8vo and fol.

—— 1707–9. *Monthly Miscellany or Memoirs for the Curious*. 3 vols. 8vo.

—— 1764. *Opera Hist. Naturae spectantia* (Ed. J. Empson), fol.

KAEMPFER, E., 1727. *History of Japan* (*Trans. by J. Scheuchzer*). 2 vols. fol.

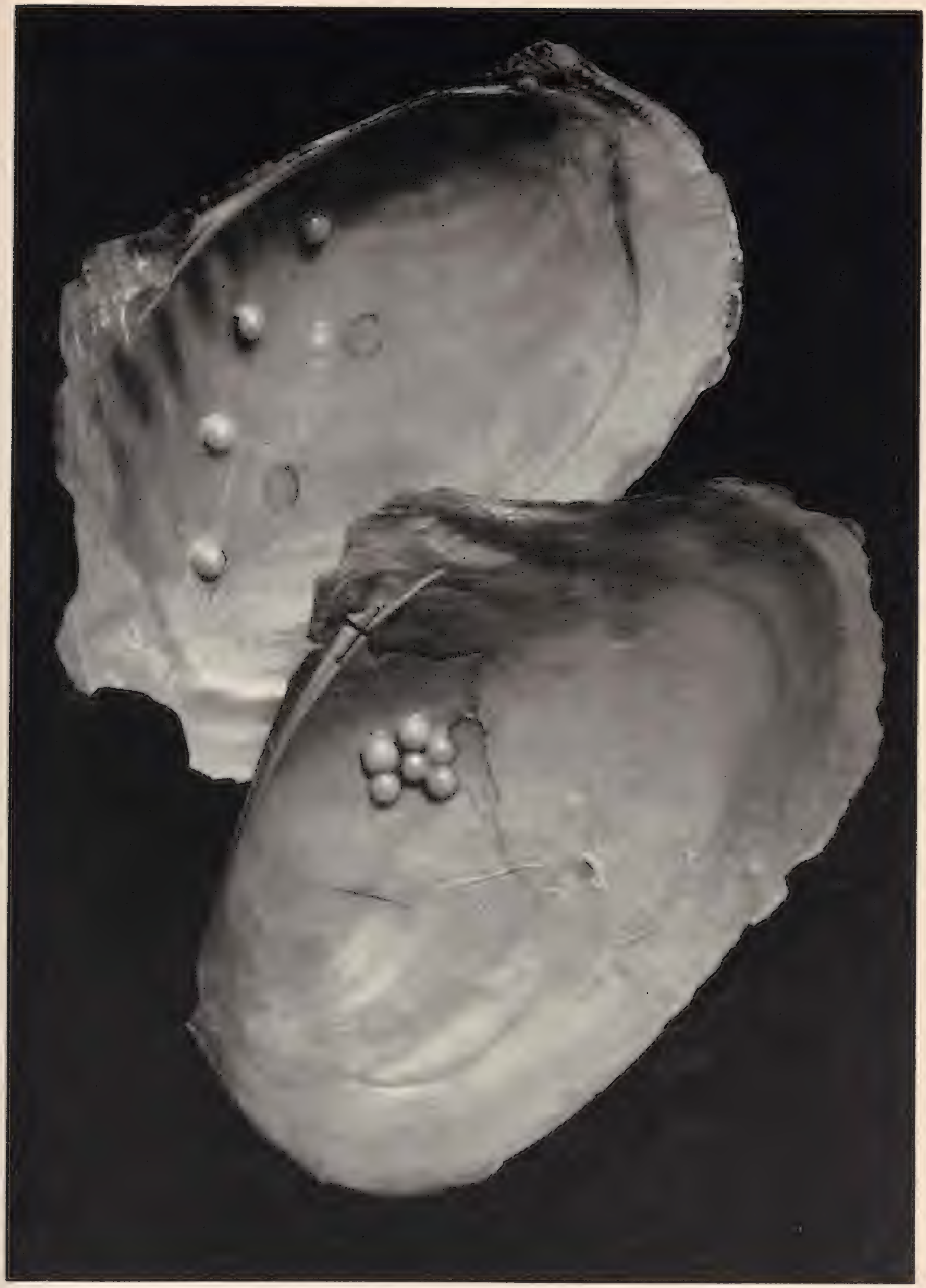
EDWARDS, G., 1758–64. *Gleanings of Natural History*. 4to.

CATESBY, M., 1731–43. *Natural History of Carolina, Florida and the Bahama Islands*. 2 vols. folio.

RYMSDYK, J. and A., 1778. *Museum Britannicum, or a display . . . of Antiquities and Natural Curiosities in . . . the British Museum*. fol.

—— 1791. *Museum Britannicum, or a display . . . of Antiquities and Natural Curiosities in . . . the British Museum*. 2nd edit. by Boyle. fol.

MATON, W., and RACKETT, T., 1803. An Historical Account of Testaceological Writers. *Trans. Linn. Soc.* 7. 4to.



[*British Museum Photograph.*]

Dipsas plicatus Leach ($\times \frac{2}{3}$).

[*To face p. 258.*

LEACH, W. E., 1814–17. *Zoological Miscellany.* 3 vols. 8vo.
DILLWYN, L. W., 1817. *A Descriptive Catalogue of Recent Shells.* 2 vols. 8vo.
SWAINSON, W., 1834. *A Preliminary Discourse on the Study of Natural History,* in Lardner's *Cabinet Cyclopaedia.* 8vo.
—— 1840. *Taxidermy, Bibliography, and Biography,* in Lardner's *Cabinet Cyclopaedia.* 8vo.
LANKESTER, EDW., 1848. *Correspondence of John Ray.* Ray Soc. **14.** 8vo.
HANLEY, S., 1855. *Ipsa Linnaei Conchylia. The shells of Linnaeus determined from his manuscripts and collection.* 8vo.
BRIGHTWELL, M., 1858. *A Life of Linnaeus.* 8vo.
NICHOLSON, H., 1886. *Natural History—its rise and progress in Britain.* 8vo.
BRITISH MUSEUM, 1906–12. *The History of the Collections in the Natural History Departments of the British Museum.* 2 vols. and app.
—— 1931. *A Short History of the Collections.* 8vo.
—— 1931. *General Guide to the Exhibition Galleries.* 8vo.
FOX, H., 1919. *Doctor Fothergill and his friends—Chapters in 18th Century life.* 8vo.
GUNTHER, R. W. T., 1928. *Further Correspondence of John Ray.* Ray Soc. **114.** 8vo.
PEATTIE, D. C., 1937. *Green Laurels—the lives and achievements of the great naturalists.* 8vo.

EXPLANATION OF PLATES.

PLATE 5.—*Strombus pugilis* L. (monstr.) and *Murex rota* Mawe. Above: reproduction of Lister's plate 906, figs. 25 and 26. Below: photographs of the actual specimens engraved by Susanna Lister, *circa* 1680. Mus. Sloane.

PLATE 6.—*Dipsas plicatus* Leach, interior of both valves of holotype, showing culture pearls (× $\frac{2}{3}$). Mus. Sloane.

***Lauria cylindracea* (da Costa) monstr. *sinistrorsum*.**—In June 1951 I found a sinistral specimen of *L. cylindracea* at Stagshaw, near Hexham, Northumberland, which is now in Epsom College museum. Although such a common species, occurring often in great numbers, sinistral individuals are very rare; the only other example known to me is one from Torquay in the collection of Mr. J. R. le B. Tomlin.

B. COLVILLE.

Snails feeding on *Equisetum*.—On 5 May 1951 many snails were seen feeding on the strobili of *Equisetum arvense* L. on the railway embankment at Boxmoor station, Herts. The snails were identified by Dr. W. J. Rees and Mr. G. L. Wilkins as *Monacha cantiana* (Montagu).

R. B. BENSON.

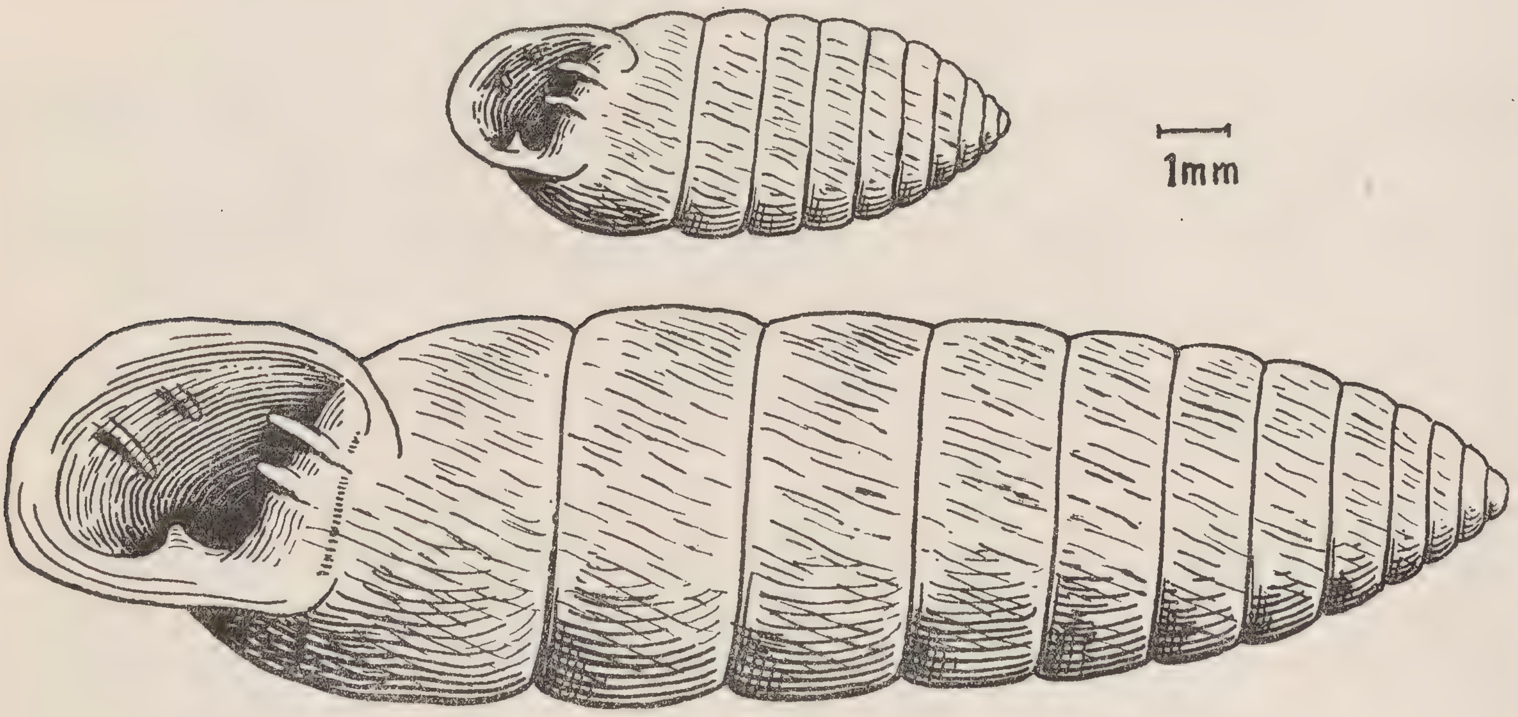
A REMARKABLE FORM OF *FAUXULUS*

By K. H. Barnard.

(*Read before the Society*, 27 *October* 1951.)

Recently a correspondent sent to the South African Museum three examples of a land shell which were found in a very restricted area in the neighbourhood of the lighthouse at Cape Agulhas.

In all essential characters they agree with *Fauxulus capensis* (Küster) but are twice as large as any recorded examples. Connolly (1939, *Ann. S. Afr. Mus.* **33**, 377, pl. 12, fig. 7) records specimens of this species up to 9·8 mm., and of the closely allied *F. ovularis* (Küster) (*op. cit.*, 379, pl. 12, fig. 8) up to 11·7 mm. The present specimens measure 20, 21 and 22 mm. in length. There is a faint dark thread-like line across the paries and around the periphery of the last whorl, and the aperture internally is fulvous.



Above: *Fauxulus capensis*, of average size and shape.
Below: *F. capensis* var. *agulhasensis*.

Although there are no features except size to differentiate this form from the normal *F. capensis*, it seems worthy of at least varietal, if not specific, rank. The name var. **agulhasensis** is proposed.

The normal form occurs in the coastal belt along the south-west corner of the Cape Province, from St. Helena Bay on the west coast to Port Elizabeth on the south coast. It never occurs far inland; its reported occurrence at Kuruman and Kimberley needs confirming (one does not doubt Connolly's identification, but old labels and second-hand reports, "*fide* . . . ", cannot always be accepted).

Connolly (*op. cit.*, 378) refers to the variation in length and contour of specimens from the Bredasdorp district, and further collecting may discover examples intermediate in size between the normal and the extreme form here recorded. No animals are available for anatomical examination.

An example has been sent to the British Museum (Natural History).

PLANORBIS ACRONICUS FÉRUSSAC IN A HOLOCENE DEPOSIT IN SURREY.

By M. Maitland Howard.

(*Read before the Society,* 18 *November* 1950.)

In view of the fact that *Planorbis acronicus* Férussac is now known living in England only in the River Thames and its tributaries, it may be of interest to record the finding of *P. acronicus* in a fossil state at Otterway's gravel pit, Staines Lane, Chertsey. Attention was first drawn to this site when excavations of Neolithic and Iron Age settlements were carried out here by Mr. W. F. Grimes, Keeper of the London Museum. Specimens of the Mollusca were then sent to the late Mr. Kennard. Later the pit was visited by Professor Zeuner's students' excursions and Mollusca were collected from it for purposes of instruction. When a determination was attempted at the Institute of Archæology, one species was identified as *Planorbis acronicus* Férussac. This was an interesting discovery, since *P. acronicus* is now only known from the following localities (all in the Thames system):—River Cherwell (Oxfordshire), River Loudwater at Cores End (Bucks), River Thames at various places between Godstow and Windsor.

As a Holocene fossil *P. acronicus* was first recorded by Woodward in 1890 (*Proc. Geol. Assoc.* **11,** 339) as a variety of *P. carinatus* Müller. It has been found in deposits at Boveney (Bucks), Wargrave, Clifton Hampden (Oxon), Uxbridge, Fulham, Westminster, Staines, Penton Hook (Middlesex), Strand, Waterloo, Vauxhall, Kew (Surrey), Walthamstow, Canning Town, Chingford (Essex) and Wallingford (Berks).

Penton Hook is very close to the deposits which are the subject of the present paper, but Cooper's section (*Proc. Malac. Soc.* **14,** 35) on the Middlesex bank cannot be correlated with those observable in Otterway's pit, on account of the great variability of the latter. It is noteworthy, however, that Cooper found his specimens in gravel, while all the Mollusca in Otterway's pit are from the silt which overlies the gravel.

Outside Britain the species is found in Siberia, Lapland, Finland and N. Scandinavia, and also in Lakes Constance and Zurich. Doubtful localities reported by Hartmann in 1841 are Lakes Paseano and Alserio near Brianza (presumably alpine Switzerland), and " Clermont " in England. It was in Denmark during the " Oak Period " (Neolithic). *P. acronicus* is predominantly a northern species with one relict area in the Swiss Alps and another in England.

Specimens from Otterway's pit were submitted to Mr. A. E. Ellis. He confirmed the determination and visited the locality, where he again confirmed the abundance of fossil *P. acronicus*, but was unable to find any living specimens in the river, nor has the writer found any at Chertsey, where extensive collections were made. One dead specimen was found this summer at Temple Island near Henley, which is, however, well within the known living range of the species. From this it would appear that the species is now extinct at Chertsey, as elsewhere in the lower reaches of the Thames.

As the whole area of Otterway's pit is being rapidly destroyed in the process of obtaining gravel, a survey of the distribution of the Mollusca was at once made. This survey showed that in addition to a flood-loam containing *P. acronicus*, there were to be traced in the area at least three old stream channels containing fossil deposits.

(A) A channel 77 feet wide and about 6 feet deep with a filling of light grey silt containing numerous *P. acronicus*. Near the base of this deposit were bones and Iron Age sherds, and below these at one spot a deposit of peat, containing *Aplexa hypnorum* (L.) and *Segmentina nitida* (Müller), which are not found elsewhere on the site. This filling had been re-excavated at a later date by a channel about 50 feet wide, which had refilled with a darker clay deposit from which *P. acronicus* was absent.

(B) A channel about 12 feet wide and 3 feet deep filled with a light grey silt containing numerous *P. acronicus*.

(C) A deeper channel about 20 feet wide containing a rather more earthy silt and with no *P. acronicus*.

On the northern side of the pit, channels (A) and (B) cut directly through the gravel ballast on which there is only a narrow turf layer, but to the south, the gravel is overlaid with flood-loam through which the continuation of Channel (A) can be clearly distinguished. It appears to bend round here in the direction of the present river, which it probably entered at a place where there is still a depression in the river bank. It seems probable that here it first united with Channel (B), as at one time there were traces of another channel through the flood-loam.

In addition to *P. acronicus* the grey silts of Channels (A) and (B) contain numerous *Theodoxus fluviatilis* (L.) as well as a great number of other species, all of which are also present in the flood-loam.

In the dark clayey second filling of Channel (A) there are comparatively fewer Mollusca, *P. acronicus* and *Theodoxus fluviatilis* are missing, but *Anodonta anatina* (L.), which is absent from the earlier filling, is here present.

Channel (C) contains a large number of Mollusca, but *P. acronicus*, *Theodoxus fluviatilis* and *Anodonta anatina* are all missing.

With the exception of *Aplexa hypnorum* and *Segmentina nitida*, which, as already mentioned, occur only in the peat, the other species listed are fairly constant throughout and all, except *P. acronicus*, are to be found in the modern river. But it is noteworthy that *Viviparus viviparus* (L.), which is now one of the commonest species in the locality, is entirely missing from all deposits, which seems to suggest that the latest of these is probably not post-Roman.

From the archæological evidence afforded by Neolithic and Iron Age sites found on the edges of one of the channels, it appears that *P. acronicus* was infinitely more frequent before the Neolithic than it is to-day. The great reduction in numbers seems to coincide with the Subboreal phase of climate, the beginning of which is marked by the decline of the elm all over north-western Europe. It is hardly possible as yet to speculate about the causes of this reduction. Perhaps it is no more than the result of the gradual reduction in numbers of a predominantly northern species which has survived from the late Pleistocene. Perhaps the change of climate which undoubtedly marks the beginning of the Subboreal has something to do with it, though paleobotanists are not yet agreed on the character of this change.

In conclusion, my very sincere thanks are due to Professor F. E. Zeuner and to Mr. C. P. Castell, Mr. A. G. Davis, Mr. A. E. Ellis, and Mr. W. F. Grimes for their great help in studying the fossils and the site, and also to Mr. Otterway and his staff for the facilities they granted me for working in the pit. Mr. Ellis has been most kind in checking determinations and identifying the small bivalves.

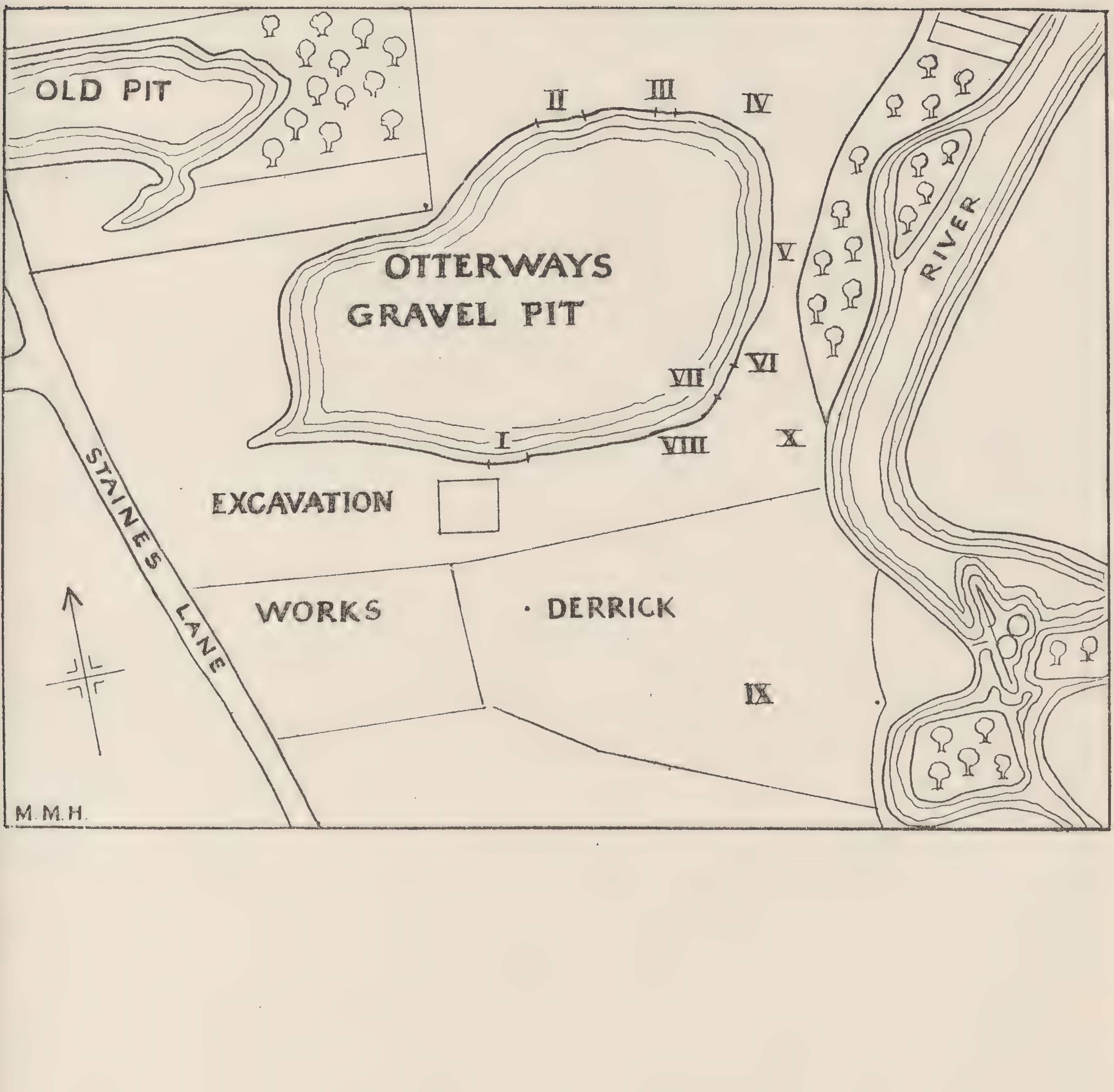


TABLE OF SPECIES

	Flood Plain		Channel A First Filling					Channel B		Channel A Second Filling		Channel C	
Samples	VI	IX	II*a*	VIII	X	Peat	'Bones'	III	VII	I	II*b*	IV	V
Species.													
Carychium minimum													R
Succinea pfeifferi	UC	UC		UC	FC		UC	R	R	UC	UC	UC	FC
Cochlicopa lubrica	R	UC	UC	R	UC			R	R				
Pupilla muscorum		R						R					
Vallonia pulchella		UC			R	UC		R	UC		FC		FC
Discus rotundatus					UC								
Hygromia hispida	FC	FC	FC	R	UC	FC	FC	UC	FC	UC	FC	FC	FC
Theodoxus fluviatilis	FC	FC	FC	VC	FC		FC	FC	UC				
Valvata cristata		UC		R	UC	UC		FC	FC	UC			
V. piscinalis	FC	FC	VC	VC	FC	FC	FC	FC	VC	UC			
Bithynia tentaculata	VC	VC	VC	VC	VC	FC	VC	FC	VC	VC	FC	FC	UC
B. leachii	UC	R	UC		FC	UC		FC	UC				
Aplexa hypnorum						UC	UC						
Acroloxus lacustris								R		R			
Ancylus fluviatilis		R	R										
Lymnaea stagnalis					R				R	R			
L. palustris		R		R						R		FC	UC
L. truncatula	UC										UC		FC
L. peregra	R	R	UC		UC		UC	UC	UC	FC	VC	VC	FC
L. auricularia			R										
Planorbis corneus			R			UC			UC	FC		UC	UC
P. planorbis	R	R	UC		UC	FC	UC	UC	UC	FC	FC	VC	FC
P. carinatus										R			
P. spirorbis					R	UC	UC	R		FC	VC	R	VC
P. vortex						UC				UC			
P. albus		FC	R	UC	R	VC	FC	UC	UC	R			
P. acronicus	UC	UC	FC	UC	UC	UC		UC	R				
P. contortus			UC		R		UC	R	UC	R			
Segmentina nitida						UC	UC						
Anodonta anatina										R			
Sphaerium corneum	R	R	UC		R	UC		UC	UC	R	R		
Pisidium amnicum	UC	R	R	R				R	UC	UC	UC		
P. cinereum		UC	R				UC	R		UC			
P. supinum			R										
P. henslowanum				R									
P. subtruncatum								UC				R	
P. pulchellum								R		UC			
P. nitidum							UC	FC					
P. milium								FC					

0–1% *rare*; 2%–5% *uncommon* UC; 6%–20% *fairly common* FC; 21%–45% *very common* VC.

REMARKS ON THE LATE MR. WINCKWORTH'S NOTES ON BRITISH MARINE MOLLUSCA.

By Henning Lemche

(*Read before the Society*, 19 *May* 1951)

The publication in this *Journal* (**23,** 131–134) of all the corrections made by the late Mr. R. Winckworth to his "List of Marine Mollusca of the British Isles" in his own interleaved copy causes me to make a few comments. As a specialist in Opisthobranchs and also as a member of the International Commission on Zoological Nomenclature, I have discussed with Mr. Winckworth some problems concerning the names of the British Opisthobranchs, and I am thus able to state that some of his notes were not ripe for publication, among them the note concerning *Cadlina* Bergh.

From the Rules, the name of this genus ought to be *Acanthochila* Mörch, 1868, which takes precedence over *Echinochila* Mörch, 1869. Stål, in 1859, proposed the name *Acanthocheila* for a bug, but this is not sufficient reason under the rules to reject *Acanthochila* Mörch for the reason of homonymy (see the Recommendation to Article 36 of the Rules, as limited by the decision in Opinion 25). In 1873 Stål altered the name to *Acanthochila*, in which spelling the name has been used for these bugs since that time. Thus it would cause unnecessary trouble to shift that name to a nudibranch. The next name for the genus now called *Cadlina* is *Echinochila*, which is available but has never been used. The late Mr. Winckworth knew that in any case, to avoid confusion, some action by the International Commission on Zoological Nomenclature had to be taken and, consulting other specialists, he came to the view that the powers of the Commission could best be exercised to preserve the name *Cadlina* now in common use. The task of presenting a formal application was left to me. The procedure conforms to the policy adopted by the Commission since its meeting at the Paris Congress in 1948, at which the far reaching decision was taken to stabilize nomenclature by using the plenary powers of the Commission to preserve, whenever possible, names well established and widely known, even if these names lack priority. Readers of this *Journal* are accordingly asked not to change the well established name *Cadlina* before the decision of the Commission has been promulgated.

FURTHER NOTE ON *CHARONIA LAMPAS* (L.).

By B. S. Kisch.

(*Read before the Society*, 27 *October* 1951.)

In two previous notes (*J. Conchol.* **23**, 37 & 84) it was observed that, on the Basque coast, *Charonia lampas* (L.) appeared to have extended its habitat as far as the lower littoral zone. Five more were noticed in that zone, at Socoa and St. Jean-de-Luz, by Mr. G. L. Wilkins and myself in June 1950, and 15 by Monsieur Arné at Guéthary, seven in July 1950 and eight in July 1951.

If further evidence were needed of its establishment in shallow offshore waters, it is afforded by the fact that on 21 and 22 July 1951 a party of boys, using submarine goggles, gathered 38 *Charonia* of various sizes in a very small area inside the bay of St. Jean-de-Luz. They were gathered at low spring tide in little more than a metre of water. A map of the bay reproduced from the charts of the Service Hydrographique de la Marine shows the depth at that locality as one metre at lowest spring tides. All the specimens were covered with the same coralline growth as the rocks among which they were found.

Two of the *Charonia* observed by Mr. Wilkins and myself at Socoa on 2 June 1950 were feeding on sea-urchins (*Paracentrotus lividus*). The urchins were grasped, spines and all, in the strong, tough foot. On 21 July 1951 Monsieur Arné observed a *Charonia* at Guéthary feeding on an urchin. It was held in the foot and the spines and shell had been broken down at the part where the animal was feeding, no doubt with the help of the acid contained in the saliva (Pelseneer, 1935, p. 125). Monsieur Arné suggests that the great abundance of sea-urchins along this coast may have something to do with the shoreward movement of the *Charonia*.

REFERENCE.

Pelseneer, P., 1935. *Essai d'Éthologie Zoologique d'après l'étude des Mollusques.*

***Divaricella* in Scilly: a correction.**—In Mr. Fowler's note in the *Journal* (**23**, 98), "dredging" should read "digging". In all four specimens of *D. divaricata* were dug up on Tresco at low tide, in slightly muddy, gravelly sand. There was practically nothing else in the ground except *Tellina tenuis* da Costa. Other noteworthy finds were *Solecurtus scopula* (Turton), *Gari depressa* (Pennant), *G. costulata* (Turton), *G. tellinella* (Lamarck), *Gafrarium minimum* (Montagu), *Venus fasciata* (da Costa) and var. *radiata* Jeffreys, and a white variety of *Tellina donacina* L., all taken alive between St. Helens and Tean.

A NEW SPECIES OF *POMACEA* FROM BOLIVIA.

By W. Blume and T. Pain.

(*Read before the Society*, 20 *January* 1951.)

[Plate 7.]

The senior author received from Mr. Zischka some time ago a small series of land and freshwater shells collected by him in the Chapara region of Bolivia. This included the small *Pomacea* described herein.

According to Mr. Zischka's letter, he had sent this species to Dr. F. Haas at the Chicago Natural History Museum, who tentatively determined it as *Pomacea rufilineata* (Reeve, 1856), and to whom we are indebted for the loan of additional material.

On comparing this shell with Reeve's type in the Cuming collection at the British Museum and with the only other authentic example known to us, from the collection of G. B. Sowerby III, now in the junior author's possession, we are of the opinion that the Bolivian shell could not possibly belong to Reeve's species as Dr. Haas suggests. The position of *Ampullaria rufilineata* Reeve, in any case, is very doubtful, since the type shell is without either operculum or locality. Sowerby's specimen also lacks operculum, but is referred by him (Sowerby 1916, 69) to the genus *Pila*, with the locality " Pegu ". He does not, however, give any reason or authority for this locality and it is certainly open to doubt. The true position of Reeve's species must therefore remain uncertain until further properly localized material is available for study. *Ampullaria rufilineata* is, in any case, rather thick and without visible umbilicus, the Chapara species on the other hand, being thin, semi-transparent and fairly widely umbilicate.

The only *Pomacea* known to us with which this little species has any features in common is *P. lineata* (Spix, 1827), from the Province of Bahia, Brazil, but this species has a far larger aperture, narrower umbilicus and deeply impressed suture. After careful examination of a considerable series of the latter we are satisfied that no connection between them exists and that the Bolivian shells represent a species so far undescribed, which we propose to name after its finder.

Pomacea zischkai *n. sp.*

The little shell is thin and semi-transparent, a little higher than broad and pretty widely umbilicated. Whorls 5, convex, a little depressed at the suture. The last whorl is irregularly malleated ; the distinct growth lines become stronger towards the aperture, from time to time being a little folded and elevated. Under a lens, fine descending (spiral) lines are visible. In younger shells these spiral lines are strongly marked towards the suture and especially coarse in the umbilical region, and in both places the periostracum shows very fine and short bristle-like or hair-like formations. In older specimens they are rubbed off or pasted up by mud. The olive brown coloured shell is ornamented, especially towards the aperture, with numerous narrow bands of dark brown colour. Aperture oblong ovate. The outer lip is thin and not expanded ; the columellar lip is only a little expanded towards the umbilicus. The interior of the aperture is light iridescent brown with conspicuous bands. Columellar lip of milky blue colour. Operculum horny, rather thin and blackish brown ; outer surface concave, the nucleus near the middle of the inner margin, with fine and closely spaced concentric growth lines ; the interior side with a rather large muscle scar. On the outer surface the concentric lines are crossed by fine radiating lines.

MEASUREMENTS (*in millimetres*).

	Length.	*Width.*	*Aperture.*	
(1)	34	29	22 × 16	Holotype
(2)	32	25	21 × 16	Paratype
(3)	33	27	22 × 15	,,
(4)	32	29	22 × 15	,,
(5)	29	25	19 × 14	,,
(6)	28	25	20 × 14	,,

No. (1) in the collection of W. Blume ; (2) Pain Collection ; (3) Chicago Natural History Museum, No. 35467 ; (4) to (6) Chicago Natural History Museum, No. 38001.

From the above table it will be seen that this species is little subject to variation, in fact the whole series examined, some 340 examples, is remarkably constant both in colour, form and size. Some specimens are more or less malleated in front and all show considerable erosion, especially about the spire, even amongst immature shells.

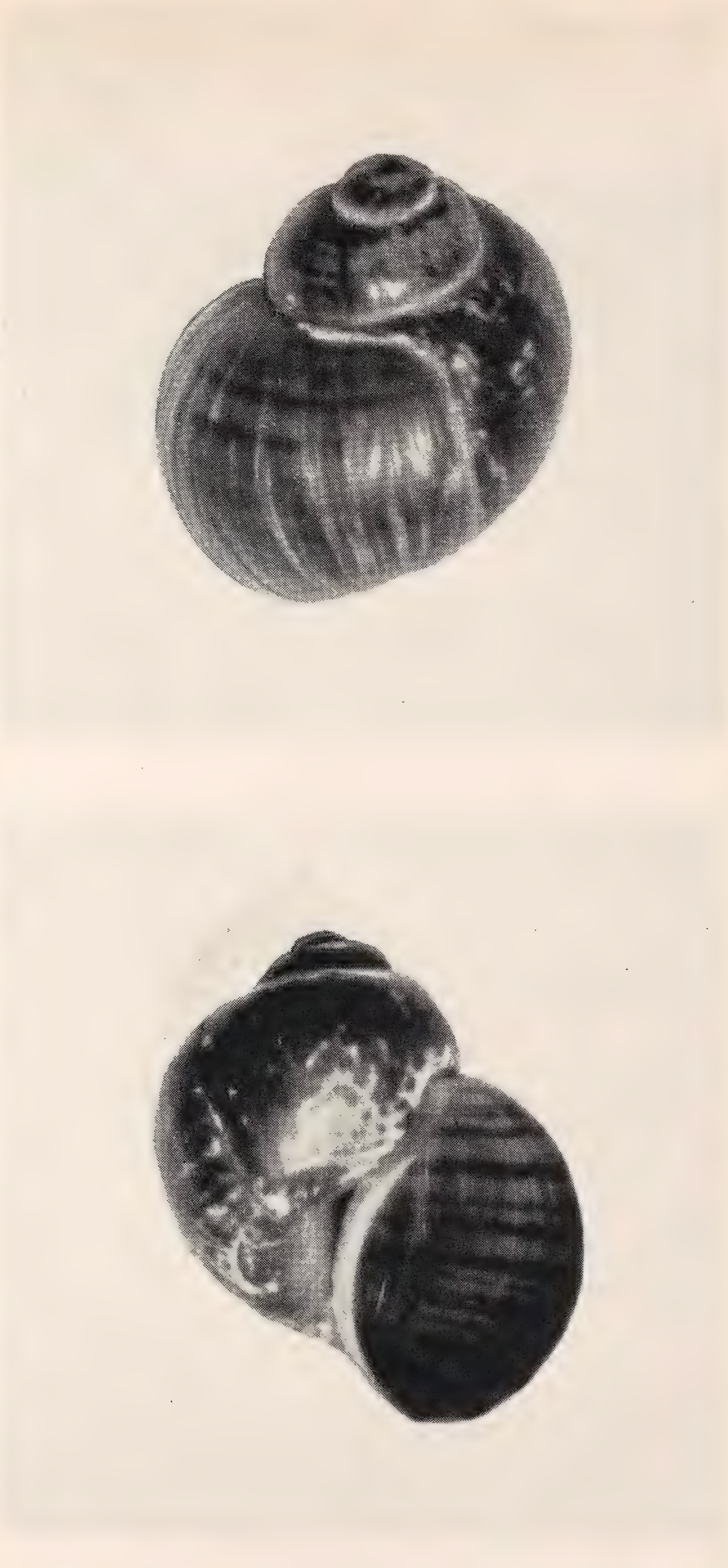
Habitat : Chapara Region, at 400 m. Bolivia tropica (Zischka).

REFERENCES.

REEVE, L. A., 1856. Monograph of the genus Ampullaria. *Conch. Icon.* **10,** Pl. 1–28 (fig. 7).

SOWERBY, G. B., 1916. Notes on the family Ampullariidae (etc.). *Proc. Malac. Soc.* **12,** 65–73.

SPIX, R., 1827. *Testacea fluviatilia Brasiliensia.* (Pl. 5, fig. 2).



Pomacea zischkai Blume & Pain (× 1½). Holotype, W. Blume collection.

[*To face p. 268.*

TRUNCATELLINA CYLINDRICA (FÉRUSSAC) IN NORFOLK.

By A. G. Davis, F.G.S.

(*Read before the Society*, 24 *March* 1951.)

The first authenticated record of this species for the county of Norfolk was made in 1935 (*J. Conchol.* **20**, 187) but details of the discovery have not been published. On reading W. G. Clark's *In Breckland Wilds* (1926, p. 29) I was delighted to learn that my old friend H. Dixon Hewitt, a well-known amateur geologist and archaeologist, had discovered this, one of our smallest and rarest British Mollusca, near Thetford in 1919. Mr. Hewitt has since given me details of the discovery and most kindly directed me to one of his original sites, where it was found alive in July 1950. My friend was searching for *Vertigo* in Two Mile Bottom on the Mundford Road when he found one live specimen under a small block of chalk, and it was determined as a *Truncatellina* by our friend B. T. Lowne. Subsequent search of this site produced only a few dead shells, but a small colony was found some hundred yards or so away. Mr. Hewitt divided his specimens of *T. cylindrica* between the Thetford and Norwich museums and individual collectors: Arthur Mayfield, B. T. Lowne and F. N. Haward. Mr. Haward very kindly gave me his collection (1950), and it included two examples collected by Mr. Hewitt in 1919. A. S. Kennard received specimens from Haward (*J. Conchol.*, *loc. cit.*).

Mr. Hewitt gave me a 6 in. map with the sites marked; the earlier site is near the 48′ bench mark on the east side of the road between two level crossings which lead to Fison's Works. The other site is a high hawthorn hedge on the west side of the road, between the 76′ and 84′ bench marks, a quarter of a mile south of the other site. Both sites are in a stretch of road known as Two Mile Bottom, a little over a mile from Thetford waterworks, on the Mundford Road from Thetford to Lynn.

The habitat consists of grassy undergrowth beneath the shelter of a high old hawthorn hedge. The photograph sent to me shows quite large trees which are considered among the finest in the county; it was taken by Mr. Hewitt as a botanical record. The soil is sandy and gravelly and overlies chalk, and both sites are relics of original breck land and hedgerow, which have escaped advancing afforestation. My son-in-law, Mr. R. Goodman, a native of Thetford, in July 1950 undertook to collect a bagful of leaves, grass and debris from the site, and in August Miss T. Goodman obtained a similar quantity, in all about half a bushel. From this, after drying and sifting, Mr. Goodman and I picked out 157 examples of *T. cylindrica*. A considerable number were juveniles of one to two whorls growth and at this stage they could easily be mistaken for *Punctum pygmaeum*. Of the total only twenty were alive, but they did not survive captivity more than a month. Mr. Goodman, while collecting the samples, found one live *T. cylindrica* half way up a blade of grass, the only other snail to be seen being a single *Helix hortensis*.

The following species were found in the siftings, and all may be regarded as living in close association with *T. cylindrica*: *Vertigo* *pygmaea* (Drap.) rare, *Lauria cylindracea* (da Costa) several, *Vallonia costata* (Müller) several, *Punctum pygmaeum* (Drap.) common, *Discus rotundatus* (Müller) several, *Oxychilus sp.* indet. juvenile, rare, *Vitrina pellucida* (Müller) rare. Mr. Dixon Hewitt found the loose shell of a *Testacella* during his early collecting here.

Truncatellina has been found (fossil) in the Neolithic flint workings at Grimes Graves, quite close to our present locality (Woodward & Kennard, 1915, *Report on the Excavations at Grimes Graves, Weeting, Norfolk,* Prehistoric Society of East Anglia, Mollusca, 220–31 ; see also *Proc. Malac. Soc.* **15,** 297).

Experts differ as to the number of species present in this country, living or fossil, and in the choice of specific names. As all the Thetford examples bear no trace of denticles in the aperture I have used the name *cylindrica.*

CLAUSILIA DUBIA DRAPARNAUD IN CURLEW PELLETS

By N. Victor Mendham.

(*Read before the Society,* 24 *March* 1951.)

At the beginning of August 1950 the Ackworth School Natural History Society was engaged in field work near Malham Tarn, West Riding, Yorks. Near the Tarn a flock of several hundred curlews (*Numenius arquata* (L.)) was put up. Three boys in the party searched the rough pasture where the curlews had been gathered and collected 25 pellets ejected by the birds. These pellets were later dissected and a general list of their contents made. Eleven of them consisted largely of the birds' cast-up gizzard linings, together with small stones and fibrous plant material. Chaetae of earthworms and remains of beetles were common in others.

One pellet, however, similar in size and shape to the others (approximately oval, 2 × 1·4 cms.), contained 21 shells of *Clausilia dubia* Draparnaud var. *suttoni* Westerlund (= *cravenensis* Taylor), which were sent to Mr. A. E. Ellis for determination. At least five of the shells were adult, the rest either immature or portions of full-grown specimens.

An examination of more pellets is necessary to decide whether the curlew is a regular predator on *Clausilia dubia* in this area. According to Witherby's *Handbook of British Birds* (**4**, 169), land snails constitute an item in the diet of the curlew, *Helix aspersa*, *H. nemoralis* and *Helicella itala* being specifically mentioned.

MOLLUSCA AT HIGH ALTITUDES IN THE SCOTTISH HIGHLANDS

By A. W. Stelfox.

(*Read before the Society*, 17 *November* 1951.)

The records given below were made during two holidays spent at Lawers, Mid Perth, in May–June 1947 and July 1951. They are merely chance observations, as I was not searching for Mollusca, but I think they indicate that if the high ground around Ben Lawers were investigated by a young and active worker in this group it might yield some interesting results, as it is mainly composed of mica schist and there is little or no accumulation of peat above 2,000 feet. The altitudes at which some of the Mollusca were observed seemed to me remarkable, but this may be due to my experience among the peat-covered hills in Ireland, where it is rare to find any Mollusca except slugs above 1,500 feet.

Helix hortensis Müller, *H. nemoralis* L. and *Arianta arbustorum* (L.) occurred together, associated with nettles, amongst fallen blocks at about 2,000 feet on the cliffs west of Lochan-na-Lairige, in a spot where sheep take shelter. *Arianta arbustorum* is of frequent occurrence on Ben Lawers itself and in the south-west corrie it lives almost to the top of the cliffs—certainly to over 3,800 feet—that is to within 200 feet of the actual summit, 3,986 feet. On 3 June 1947 a large snow-patch still lay in the bed of this corrie at over 3,000 feet and my wife picked up a specimen of *Arianta* crawling away from the melting edge of this snow, under which it had probably been buried for seven or eight months. The specimen taken at 3,800 feet measured only 15 mm. in maximum diameter, although it has a well formed lip. It was on a ledge of the cliff on which grew the willow *Salix reticulata.*

Hygromia hispida (L.). On 30 June 1951 I took a half-grown specimen of this species at about 2,000 feet on the cliffs west of Lochan-na-Lairige, with *Helix nemoralis* and *Arianta arbustorum.*

Vitrea crystallina (Müller). A very large dead shell was found under a stone on Craig-na-Caillich at about 2,500 feet.

Lymnaea peregra (Müller). A high spired " *ovata* " form, *ca.* 17 mm. in height, lives in Lochan-nan-Cat in the north corrie of Ben Lawers, *i.e.* above 2,300 feet. This is a large clear-water tarn in which grow *Potamogeton praelongus* and other water plants ; the shores are subject to considerable wave action in rough weather. It is surprising therefore to find such a form of *L. peregra* in such a habitat and at such an altitude. On the col dividing the above basin from that of the Yellow Corrie, which drains into Glen Lyon, at over 2,700 feet, I was on 17 July 1951 examining a species of *Chara* growing in one of the numerous flat, marshy, spots ; near by I observed what appeared to be some kind of globular alga protruding from the oozy mud of a runnel covered by a couple of inches of slowly flowing water. On investigation these globular objects proved to be the shells of *L. peregra* almost buried in the soft ooze. In shape their shells are similar to those living in Lochan-nan-Cat, but in height they range from 5 to 9 mm. only, and in most cases the apex of the spire was missing due to erosion, but what caused the erosion

I cannot say. The flat col on which the habitat for these *Lymnaea* lies had lain beneath an extensive snow field for many months, the last remains of which had only melted in the previous week. These marshy spots in this area are known to botanists as " micaceous bogs " and in them grow some of the rarer plants to be found in this district. The actual spot where the *Lymnaea* was found is the lowest part of the col where a tributary of the Lawers Burn arises from some springs and flows southwards into Loch Tay.

À PROPOS DE LA FAUNE MALACOLOGIQUE DU LAC KIVU.

By Dr. E. DARTEVELLE.

(*Read before the Society*, 19 *May* 1951.)

J'AI lu avec intérêt la petite note de Mr. B. Verdcourt sur " *Bithynia alberti* Smith in Lake Kivu " (*J. Conchol.* **23**, 154). En effet cette espèce n'est pas signalée par Pilsbry et Bequaert au Lac Kivu, alors qu'ils la mentionnent du Congo belge, dans les lacs Albert et Edouard, mais il a paru depuis diverses publications sur la faune malacologique du Lac Kivu :—

1. Gambetta, L., 1932, *Boll. Zool. Anat. comp. Torino* **42** (3), no. 21, 1–26.
2. Schouteden, H., 1933, *Bulletin des Séances de l'Institut Royal Colonial belge* **4**, 519–527.
3. Schwetz, J., & Dartevelle, E., 1944, *Mém. Inst. Roy. Col. belge* **14**, fasc. 2.
4. Dartevelle, E., & Schwetz, J., 1947, *ibid.*, fasc. 4.

Dans toutes ces publications la présence de *Bithynia* (*Parabithynia*) *alberti* est signalée, à la fois comme espèce actuelle au Lac et comme subfossile des terrasses lacustres. Des exemplaires vivants avaient même été envoyés par M. Vercammen-Grandjean de Costermansville et ont été élevés pendant un certain temps dans les aquariums du Musée de Tervuren. Au point de vue des terrasses du Lac Kivu, je signalerai encore ma publication, *Bulletin du Service géologique*, Léopoldville, Congo belge, no. 3, 1947, 97–145 [1948].

On trouvera dans mes mémoires des détails sur les autres espèces signalées par Mr. Verdcourt, et notamment sur les Planorbes du Lac Kivu, *Biomphalaria choanomphalus* notamment, qui prend dans le Lac une taille très grande et dont la coquille est assez épaissie. J'ai mis ces détails en rapport avec la teneur en sels de calcium des eaux du Lac.

ADDITIONAL NOTES ON NORTHERN *HELICELLA*

By Hans Schlesch.

(*Read before the Society*, 17 *November* 1951.)

Helicella caperata Montagu was found by me new to Sweden on the southern slopes of the residual-deposits from the lime-quarry of Limhamn south of Malmö in S.W. Scania on 29 April 1951, and also at the lime-quarry of Klagshamn, a short distance south of Limhamn, on 3 June 1951, but it does not occur, so far as I am able to ascertain, inland in a lime-quarry east of Malmö, and I also looked without success for it at Kåseberga åsen at Löderup Strandbad in S.E. Scania. The introduction in Scania seems to be of rather recent date. Mr. John Bernström kindly informs me that he noticed *H. caperata* at Gudhjem and Svaneke in N.E. Bornholm in 1939. Dr. N. Nifontoff took *H. caperata* on two further localities on Rügen in August 1951.

In order to clear up the question of the Gotland *Helicella* I went in June 1951 on this pretty isle in the Baltic Sea. I was lucky enough to collect some living *Helicella* (*Xeroplexa*) *geyeri* (Soós) on the roadside at Bästs träsk, 57° 50′ N., north of Fleringe in N. Gotland, which were kindly confirmed by Dr. L. Forcart and Mr. Hugh Watson. It occurs there in very dry conditions between grass and stones under bushes of *Juniperus communis* L. Lohmander does not give any exact locality for his *H. geyeri* except " Fleringe ", but at this small village I could not trace this species. As Fåröen is a military area, unfortunately I was not allowed as a foreigner to go there. Whether that dead specimen found by Dr. Hubendick on Aurgrund opposite Fåröen belongs to *H. geyeri* I do not want to take the responsibility of deciding, as especially in this group similar shells may belong to different species, and can only be determined by anatomical examination. It is the more desirable to settle this question, however, since *Helicella* (*Candidula*) *candidula* (Studer) seems also to occur at Bästs träsk, N. Gotland, as Hugh Watson, among those specimens sent to him, found one " undoubted *H. candidula*, judging both from its shell and its genital organs which agree closely with the figures thereof ". Mr. Hans Kauri, M.Sc., sent me some specimens in alcohol from Grötlingbo, S.E. Gotland, 57° 8′ N., collected 9 July 1951, which turned out to be *H. candidula* new to the fauna of Gotland, and some living *H. geyeri* from Fleringe, Sept. 1951.

Helicella (*Helicopsis*) *striata* (Müller) possibly does not occur on Gotland though so widely distributed on Öland. It is also omitted by Lindström (*Om Gotlands nutida Mollusker*, 1868). Munthe (*Gottlands senkvartära historia*, 1910, p. 139) mentions : " *Helix* cfr. *striata* Müll." from supralittorinal humus at Fröjel in S. Gotland, but according to Halle (*En fossilförande kalktuff vid Botarfve i Fröjels socken på Gotland*, 1906) the determination is not quite certain.

Regarding the occurrence of *Helicella* (*Candidula*) *gigaxi* (Pfeiffer) on Möen, this is to be struck off the list after careful examination by Ellis, Forcart and Watson of the specimens, which simply belong to a colour mutation of *H. candidula*. Watson kindly examined my material of central

German *Helicella*, and confirms that those from Mascherode, nr. Brunswick, belong to *H. gigaxi* and those from Coburg to *H. candidula* (Schlesch. *J. Conchol.* **23**, 1951, 137). Concerning the anatomical relations, Watson points out that all *Helicellae* possess a single well developed bursa (i.e. spermatheca), and all of the three subgenera that concern us lack an appendiculum. It is the dart-sacs that vary. In *Candidula* (*H. caperata*, *H. gigaxi* and *H. candidula*) there is only one large dart-sac ; in *Helicopsis* (*H. striata*) there are two (each with an accessory sac) ; in *Xeroplexa* (*H. geyeri*) there are two small degenerate empty dart-sacs. Germain (1930) also erred about *H. geyeri* ; he wrongly stated that its genital organs resemble those of "*Candidula unifasciata*", having only one dart-sac. He is also wrong in saying that the species is completely indeterminable without examining the genital organs, because of its absolute resemblance to *H. striata*, which is scarcely true.

I hereby tender my best thanks to Dr. L. Forcart, Hugh Watson and A. E. Ellis, as well as to H. Kauri, for assistance.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

702nd Meeting (Annual Meeting), held at the British Museum (Natural History), 17 February, 1951.

The President in the chair.

Member Deceased.

The President announced the death on 25 January of Mr. Alan Poole Gardiner, a former President of the Society and Recorder of Marine Mollusca since 1931.

Election of Scrutineers.

Mr. H. F. Jones and Mr. T. Pain were elected Scrutineers.

Election of Auditors.

Mr. A. G. Davis and Dr. W. J. Rees were elected Auditors for 1951.

Statement of Accounts.

The Hon. Treasurer reviewed the finances of the Society and presented the audited accounts for the year 1950, which were adopted.

Annual Reports.

The Reports of the Council, Yorkshire Branch, North Staffordshire Branch, and the Recorders for Marine and Non-marine Mollusca were presented and adopted.

Election of Officers and Council.

President : Mr. G. L. Wilkins. *Hon. Treasurer :* Mr. A. E. Salisbury. *Hon. Secretary :* Mr. C. P. Castell. *Hon. Editor :* Mr. A. E. Ellis. *Recorders :* Non-marine Mollusca, Mr. A. E. Ellis ; Marine Mollusca, Mrs. N. F. McMillan. *Council :* Mrs. E. M. Morehouse, Mr. L. W. Stratton, Mr. J. F. M. de Bartolomé, Mr. A. G. Davis, Dr. W. J. Rees.

Votes of Thanks.

Votes of thanks were passed to the Trustees of the British Museum (Natural History) for permitting the Society to hold its meetings in the Museum; to the authorities of the Leeds Museum for housing the Society's library and cabinets; and to the Officers and Members of Council for their work on behalf of the Society. The President referred especially to the valuable services rendered by the retiring Hon. Secretary, Mrs. McMillan, and was asked to convey to her the thanks of the Society.

Presidential Address.

The President delivered an address on "The Shell Collections of Sir Hans Sloane", illustrated by specimens from the Sloane collection, manuscript catalogues of Sloane's, and other works.

Exhibits.

Col. C. J. F. Bensley: *Lymnaea stagnalis* showing the effect of environment on size; *L. peregra* from R. Lyn, Devon, showing the effect of a swift stream on shell form; *Planorbis corneus* var. *rubra* eaten by crayfish in an aquarium, showing how the perimeter of the shell had been ripped off.

Mr. A. Blok: species of *Liotia*, *Cyclostrema* and allied genera; specimens showing the action of enemies or other causes of damage to living shells, disguises in Mollusca, and commensals and Mollusca living in association with one another or with other marine animals.

Mr. D. E. Brown: *Achatina schweinfurthi* Martens and *A. weynsi* Dautzenberg from the Belgian Congo.

Mr. A. G. Davis: Granules of recent *Arion ater* and of Holocene and Pleistocene *Arion* spp.

Mr. H. F. Jones: *Cypraea arabica* to show the effects of disease on colour.

Mr. T. Pain: species of *Strophochilus* from South America.

Mr. G. W. Pitchford: *Helix nemoralis* and *H. hortensis* from Nottinghamshire; living *Vertigo pygmaea*; American freshwater Gastropoda from the T. E. Stephens collection.

Dr. H. E. Quick: *Agriolimax caruanae*, Bromborough, Cheshire, collected by Mrs. McMillan, January 1951; *Ena obscura* var. *albina*, Abinger Hammer, Surrey.

Mr. L. W. Stratton: species of *Austrosipho* Iredale from New Zealand.

Report of the Council.

During 1950 the Society has made good progress and the total membership now stands at 170, including two honorary members and 168 ordinary members, a gain of 10 on last year.

The Society has suffered serious loss in the deaths of several well-known members, notably R. Winckworth, a member since 1913 and an expert upon British and Indian marine shells, and A. P. Gardiner, our marine Recorder. We also have to deplore the loss of A. L. Darrah, W. D. Fisher, C. D. Heginbotham and A. G. Stubbs.

The Acting Librarian, Mrs. Thurgood, continues to do excellent work, especially in connection with the growing list of orders for the *Journal*, and valuable help has also been given by Miss Kathleen Morehouse, who most generously gave a week of her holidays to sorting and arranging the Library and to whom the Council expresses its thanks. The Library, despite all the work expended upon it by Mr. Thurgood and later by Mrs. Thurgood, still requires a great deal of attention, as it was received in a chaotic state from Manchester. In addition, space is very limited in the Library's present quarters and these cramped conditions make any sorting operations most difficult. Miss Morehouse has kindly promised further help and her assistance will be warmly welcomed.

Nine ordinary meetings have been held during 1950 at the British Museum (Natural History). The holding of five field meetings for members in the London area proved highly successful.

One number of the *Journal of Conchology* was published in 1950, namely vol. 23, no. 4, issued on 19 July.

Report of the Yorkshire Branch.

The year has been a successful one, four indoor meetings being held, but two of the three outdoor meetings were marred by rain. On 28 January Mrs. McMillan gave a most interesting talk on "Freshwater Mollusca and their habits", describing her work in the Bromborough district. On 25 February Dr. J. W. Jackson gave an instructive lecture on "Some interesting Shells", dealing with commensalism in Mollusca and describing the habits of some peculiar species. Mr. J. H. Lumb addressed the Branch on 25 March on "Dr. Lea and the Unios", reviewing the work of Lea in classifying the Unionidae of N. America.

The excursion to Harewood on 17 June produced only *Anodonta cygnea* and *Unio tumidus*, whilst the visit to Kippax on 15 July was spoilt by heavy rain. A joint ramble with the Doncaster Scientific Society on 16 September to Cridling Stubbs produced only a few dead shells belonging to six species before rain made further collecting impossible.

There are now 21 members of the Branch. The death of Mr. W. D. Fisher whilst on holiday in France is deeply regretted; like his father, he was a keen member and could always be relied upon to contribute his quota to the proceedings either by exhibits or comment.

A. S. COOKE.

Secretary's address: S. G. Appleyard, 29 Berkeley Mount, Leeds 8.

Report of the North Staffordshire Branch.

Nothing of particular interest has been reported by our few remaining members. We still retain our interest in local Mollusca and hope to continue to do so. *Milax gracilis* (Leydig) is certainly on the increase in my district, Longton, where it occurs in the vicinity of gardens and allotments. One exception is a single specimen found on the site of a derelict brick-works in Weston Sprink, an old standing wood near Longton. Although I have worked this locality many times this is the only example of *M. gracilis* observed.

B. BRYAN.

Recorder's Report : Non-marine Mollusca.

Somerset N. (6) : *Arion rufus*, Monkton Combe, D. G. Brown ; *Sphaerium pallidum*, Clevedon (Holmes collection, Norwich Castle Museum).

Kent W. (16) : *Arion ater s.s.*, Beckenham, A. G. Davis.

Surrey (17) : *Testacella maugei*, Cheam, R. P. Smith.

Essex S. (18) : *Arion rufus*, Chingford, A. G. Davis.

Essex N. (19) : *Assiminea grayana*, R. Stour near Dedham, H. E. Quick.

Berkshire (22) : *Carychium minimum s.s.*, Pangbourne, *C. tridentatum*, Chazey Wood, Reading, *Arion rufus*, Basildon, H. E. Quick.

Oxford (23) : *Carychium tridentatum*, Coombe End, *Arion ater s.s.*, Peppard, H. E. Quick ; *Testacella maugei*, Oxford (Holmes collection).

Bedford (30) : *Vertigo substriata*, Flitwick (Holmes collection).

Pembroke (45) : *Lauria anglica*, Haverfordwest (not new county record), *Hygromia subvirescens* (= *H. revelata*), Newgale, 1938, R. P. Smith.

Flint (51) : *Planorbis laevis*, Holocene, Caerwys, J. O'N. Millott.

Anglesey (52) : *Hydrobia ventrosa*, Cemlyn Bay, J. O'N. Millott.

Lincoln N. (54) : *Assiminea grayana*, New Holland, A. Smith.

Notts (56) : *Carychium tridentatum*, *Vallonia excentrica*, Southwell, G. W. Pitchford.

Cheshire (58) : *Arion ater s.s.*, *Agriolimax caruanae*, Bromborough, Mrs. N. F. McMillan.

Yorks S.E. (61) : *Assiminea grayana*, Hessle, A. Smith ; *Hydrobia ventrosa*, Walker Butts Bank Dyke, *H. ulvae*, *Phytia myosotis*, Welwick, Dr. P. M. Butler.

Westmorland (69) : *Planorbis vortex*, Kendal, T. T. Macan.

Dunbarton (99) : *Bithynia tentaculata*, *Lymnaea auricularia*, *Dreissena polymorpha*, Forth and Clyde canal, W. Russell Hunter.

South Ebudes (102) : *Acanthinula lamellata*, *Zonitoides nitidus*, *Hygromia subrufescens* (= *H. fusca*), Garvellach Islands, W. Russell Hunter.

The records of greatest interest are those of *Hygromia subvirescens* (Bellamy) from Pembrokeshire and *Assiminea grayana* Fleming from the Humber. The few additional records of *Arion rufus* show that it is widely dispersed in the southern part of the country ; this species has not yet been authenticated from any locality north of Cambridge.

A. E. E.

Recorder's Report : Marine Mollusca.

Mr. W. Fowler has been to Oban and Scilly again and collected a large number of rare species. As is to be expected, there are few new species to be reported from such well-worked regions, indeed most of them have been taken previously by Mr. Fowler himself. His records are valuable, however, as recent evidence of the persistence of some species and the dying out of others. The numbers which follow refer to Winckworth's List (*J. Conchol.* **19**, 217) ; in the case of new records for the region the name is also given.

Oban: LORICATA: 4, 5, 6, 12 *Ischnochiton albus* (L.); GASTROPODA: 3, 5, 15, 16, 17, 24, 60b *Alvania beani calathus* (Hanley), 163 *Turbonilla jeffreysi* (Forbes & Hanley), 166, 167 *Capulus ungaricus* (L.); LAMELLIBRANCHIA: 7, 12, 18, 28, 31 *Musculus niger* (Gray), 45, 48, 49, 50, 51, 52, 54, 56, 97.

Scilly: LAMELLIBRANCHIA: 108, 130, 131, 132, 133, 174.

A new observer for the Census work, Mr. G. W. Pitchford, has sent in a very full list for Region X. This again is a part of the coast where it is difficult to make new records, containing as it does the well-worked Isle of Man, North Wales and S. Lancashire coasts. His report is of interest, however, in that it includes a portion of the less known Cumberland coast.

Walney Island, 27 August 1950: GASTROPODA: 25 on boulders, 41 and 45 on *Fucus serratus*, 190 browsing on barnacles, all at Hollow Scar.

Flenswick Bay, St. Bee's Head, 28 August 1950: GASTROPODA: 7 on sandstone rocks, 41, 42 f.

Silcroft to Haverigg, 30 August 1950: GASTROPODA (dead): 87, 176. LAMELLIBRANCHIA: 110 *Petricola pholadiformis* Lamarck, 103, 112; dead shells of 20, 22, 35, 44, 84, 87, 103, 106, 112, 117, 120, 129, 135, 137, 141, 142, 143, 145, 159 *Zirfaea crispata* (L.); the last has been recorded from the Isle of Man but not the mainland.

Askam to Lowsy Point, Duddon estuary, 1 September 1950: GASTROPODA: 41 on *Fucus vesiculosus* boulders, 48 on mudflats with *Aster tripolium*, etc.; dead shells of 45, 87, 170. LAMELLIBRANCHIA: 93, 123, 124, 148; dead shells of 20, 42, 84, 87, 103, 117, 123, 137, 141, 145, 147, 159.

Earnse Point to Hollow Scar, Walney Island, 4 and 6 September 1950: GASTROPODA: 7, 10, 25, 41, 42 f, 43, 45, 190; dead shells of 20, 42, 87, 170, 192, 203. LAMELLIBRANCHIA: 20; dead shells of 42, 44, 84, 93, 96, 105, 106, 112, 117, 137, 143, 147. LORICATA: every variety of 7.

A. P. GARDINER.

703rd Meeting, held at the British Museum (Natural History), 24 March 1951.

The President in the chair.

Electon of Member.

Mrs. Alison Mary Winckworth, 71 Whitworth Road, South Norwood, S.E. 25.

Communications.

"*Truncatellina cylindrica* (Férussac) in Norfolk," by A. G. Davis.

"*Clausilia dubia* Draparnaud in Curlew pellets," by N. V. Mendham.

Exhibits.

Special exhibit: Trigoniidae.

The President and Mr. C. P. Castell: recent and fossil Trigoniidae from the collections in the British Museum (Natural History).

Mr. A. G. Davis: specimens, map and photograph to illustrate his paper; hibernating *Helix pomatia*.

Mr. A. E. Ellis: *Hygromia subvirescens* (Bellamy), Newgale, Pembrokeshire, collected by Mr. R. P. Smith, of Belmont, Surrey, in 1938.

Mr. T. Pain: *Rangia cuneata* (Say) and *Cyrena carolinensis* Bosc, Mobile, Alabama.

704th Meeting, held at the British Museum (Natural History), 21 April 1951.

The President in the chair.

Election of Members.

Mrs. M. Ainsley, 16 Belmont Road, Twickenham, Middlesex.

P. Coxhead, 57 Park Avenue North, Hornsey, London, N. 8.

T. E. Crowley, B.Sc., A.M.I.E., M.I.Ec.E., 29 Pembridge Square, London, W. 2.

Exhibits.

Special exhibit: *Buccinum*.

The President: *Buccinum undatum* from the Norman collection.

Mr. J. F. M. de Bartolomé: *Neptunea antiqua*, Tain, Ross.

Mr. C. P. Castell: British Pliocene and Pleistocene *Buccinum* from the British Museum collections.

Dr. H. E. Quick: *Agriolimax reticulatus*, albino, Midhurst, Sussex; living *Helicodonta obvoluta*, South Harting, Sussex; *Succinea archeyi* Powell, Auckland, New Zealand (recently collected).

705th Meeting, held at the British Museum (Natural History), 19 May 1951.

The President in the chair.

Election of Members.

The Science Library, University College of North Wales, Bangor, Caernarvonshire.

Mrs. Thurgood, 16 Moss Gardens, Alwoodley Park, Leeds.

Communications.

"Remarks on the late Mr. R. Winckworth's Notes on British Marine Mollusca," by Dr. Henning Lemche.

"À propos de la faune malacologique du Lac Kivu (Congo belge)," by Dr. E. Dartevelle.

"Miscellaneous Records," by B. Verdcourt.

"Snails feeding on Equisetum," by Robert B. Benson.

Exhibits.

Special exhibit: British Cephalopoda.

Dr. W. J. Rees: British Cephalopoda from the British Museum collections.

Mr. A. G. Davis: darts of British Helicidae; *Helix nemoralis*, Neolithic, Grimes Graves, Norfolk; *Helicigona lapicida*, Abinger, Surrey; *Hygromia cinctella*, Paignton, and two miles west of Teignmouth, South Devon.

706th Meeting, held at the British Museum (Natural History), 27 October 1951.

The President in the chair.

Member Deceased.

The President reported the death of Mr. Harry Overton, who had been a member of the Society for 55 years.

Resignations.

Mr. Arthur Mayfield, Mr. T. G. W. Fowler, Mrs. Fowler.

Election of Members.

Edward Oliver Bishop, 5 Hanbury Park Road, St. John's, Worcester.

Arthur James Cain, M.A., D.Phil., Department of Zoology and Comparative Anatomy, University Museum, Oxford.

Mrs. M. M. Davis, 75 Croydon Road, Anerley, London, S.E. 20.

Major Robert John Griffiths, Rosslyn, Edward Road, Biggin Hill, Kent.

Charles William Hunt, B.Sc., Keeper of Biology, Museum and Art Gallery, New Walk, Leicester.

Cyril Allan Raffray, 20 Devonshire Road, Salisbury, Wilts.

Zoological Survey Department, Government of Pakistan, 183 McLeod Road, Ispahani Building, Karachi 1, Pakistan.

Mr. James Eddowes Cooper (elected 1892, President 1932–33) was elected a Life Member in recognition of his long and valued services to the Society.

Communications.

" A remarkable form of *Fauxulus*," by Dr. K. H. Barnard.

" Further notes on *Charonia lampas* (L.)," by B. S. Kisch.

" A note on the distribution of *Psichion*," by B. Verdcourt.

" Notes on some Mollusca from the Lake Kivu area," by B. Verdcourt.

Exhibits.

Special exhibit: *Helix aspersa* Müller. Specimens illustrating the variation of *H. aspersa*, and sinistral, scalariform and " *cornu copiae* " aberrations, were exhibited by the President (from the British Museum collections), Mr. A. G. Davis, Mr. A. E. Ellis, Mr. L. W. Stratton and Mr. A. E. Salisbury.

Mr. C. P. Castell: Holocene and Pleistocene *H. aspersa* from the Kennard collection.

Mr. A. G. Davis: *Aetheria elliptica* Lamarck, Ibadan, S. Nigeria; *Helicodonta obvoluta*, Mickleham, Surrey (Holocene), and Sussex.

Miss Maitland Howard: Pleistocene land and freshwater shells from Mosbach, Germany.

Mr. T. Pain: species of *Otopoma* from S. Arabia, Socotra and Somaliland.

Mr. G. W. Pitchford: Japanese land shells collected by Professor Masao Azuma.

Dr. H. E. Quick: radula, spermatophore and genitalia of *H. aspersa*.

Mr. L. W. Stratton: *Anodonta cygnea* and *A. anatina*, Hillfield Park, Aldenham, Herts.

707th Meeting, held at the British Museum (Natural History), 17 November 1951.

The President in the chair.

Communications.

"Traill's List of Orkney Mollusca," by Robert Rendall.

"Additional notes on northern *Helicella*," by Dr. Hans Schlesch.

"Mollusca at high altitudes in the Scottish Highlands," by A. W. Stelfox.

Exhibits.

Special exhibit: Commensals.

The President: examples of marine Mollusca with their commensals, from the British Museum collections.

Mr. T. Pain: *Aetheria elliptica* Lamarck, Ibadan, S. Nigeria; ditto var. *tubifera* Sowerby, R. Nile, Sudan; *Bartlettia stefanensis* (Moricand), R. Maranon, Iquitos, Peru; *Acostaea lobata* (Deshayes), Bogota, Colombia.

Dr. H. E. Quick: *Cochlicopa lubrica* (Müller) and *C. minima* (Siemaschko); spermatophore of *Milax budapestensis* (Hazay).

708th Meeting, held at the British Museum (Natural History), 15 December 1951.

The President in the chair.

Election of Members.

William Russell Hunter, B.Sc., F.G.S., Department of Zoology, The University, Glasgow, W. 2.

David Rainsford Sheldon, Geology Department, Canterbury University College, Christchurch, New Zealand.

Communication.

"A note on the distribution of *Anodonta cygnea* (L.), having regard to differences in sex and gill-structure: III," by H. H. Bloomer.

Exhibits.

Special exhibit: Volutidae.

The President: Examples of Volutidae from the British Museum collections.

Mr. C. P. Castell: fossil Volutidae from the British Museum collections.

Mr. A. G. Davis: Eocene Volutidae, including *Volutospina elevata*, London Clay, Lower Swanwick, Hants, and *Volutocorbis crenulifera*, Bracklesham Beds, Southampton.

Mr. T. Pain: *Auris chrysostoma* and var. *swainsoni*, *A. egregia*, *A. bernardi*, *A. bilabiata*, *A. melastoma* and *A. illheocola*, Bahia, Brazil.

Dr. H. E. Quick: *Limax poirieri*, Swansea, Teneriffe and California; *L. marginatus*; *L. nyctelius*, Edinburgh.

Mr. L. W. Stratton: Volutidae from Australia and New Zealand; scalariform *Lymnaea stagnalis*, Aldenham, Herts; *Cochlicella acuta*, W. Cornwall, N. Devon and Sussex.

FIELD MEETINGS.

Radlett, Herts, 26 May, 1951. Leader, Mr. L. W. Stratton. This meeting, held jointly with the Hertfordshire Natural History Society, to investigate the Mollusca of old chalk pits, was marred by heavy rain. The big pit at Moses Dell was found to be filled with a huge mass of clay, the fate of several local pits. Members were, however, able to find a number of *Laciniaria biplicata*, descendants of those introduced by Boycott (see *J. Conchol.* **23**, 43). *Marpessa laminata* and *Clausilia bidentata* were plentiful. *Helicella gigaxi*, not previously recorded from this pit, was also taken, bringing the total number of species up to 27. Many of the commoner species of snails and slugs were also in evidence.

L. W. S.

East Horsley, Surrey, 27 May and 23 June 1951. Leader, Mr. A. G. Davis. Two meetings, the former in conjunction with the London Natural History Society, were held in the chalk woodland south of the Guildford road. Thirty-seven species of land Mollusca, the majority of which are abundant, have been recorded from this locality. The wood is mainly beech, where it has not been replanted, with a fair sprinkling of old trees, a little holly scrub and a ground flora of *Mercurialis perennis*. The best habitats are where the chalk shows through; where it is masked by superficial deposits the molluscan population dwindles to nil. A tongue of grass and arable land, Sheep Leas, runs up southwards through the woodland and supports a thriving colony of *Helix pomatia*, with colonies of *H. nemoralis* and *H. hortensis* in thickets of Clematis and bramble. On 27 May many of the Mollusca were engaged in tree climbing: on most of the trunks there were many young *Arion ater* (50 on one tree), with a few *Limax maximus*. *Helicigona lapicida*, *Helix nemoralis*, *Marpessa laminata* and *Ena obscura* were numerous on the trunks of young beeches. The undergrowth yielded *Clausilia rolphi* and other geophilous species. A site where *Acme fusca* is usually to be found was visited and bags were filled with dead leaves for sifting later. On 23 June the weather was drier and tree climbing was not so evident, though a few *H. lapicida* were seen. *Helix aspersa* was observed paired. Three species were added to the list for this locality.

Mortlake and Chiswick, 21 July 1951. Leader, Mr. A. G. Davis. The towpath from Barnes Bridge to Mortlake was followed for the headquarters of *Laciniaria biplicata*. A thriving colony is present, but there were many dead shells as a result of recent hedge trimming and burning. Other colonies were pointed out along the railway embankment on the Chiswick side of the R. Thames and on the river bank at the Chiswick end of Barnes Bridge, where a small colony survives occasional flooding. There is another small colony near by amongst nettles on waste ground belonging to the Sports Club. *Helix aspersa* was seen in large numbers on walls by the towpath on the Surrey side, whilst among nettles bordering the road on the Middlesex side is a large and variable population of *H. hortensis*.

A. G. D.

Norbury Park, Mickleham, Surrey, 25 August 1951. Leader, the President. At the meeting held here in 1950 (*J. Conchol.* **23**, 167) two dead shells of *Helicodonta obvoluta* were picked up, and an object of the present meeting was to ascertain whether this species still lives in the locality. A further 17 examples were collected, all dead and bleached; the writer has since spent a whole day searching the site for living specimens without result. How long these shells have been dead is difficult to determine. Most were obtained by searching the chalky rubble after removing its mossy covering. This revealed much disturbance of the soil and rubble by the burrowing of rabbits. Other specimens were found in rubble which had been exposed by the uprooting of trees in a recent gale. Among the material thrown out by rabbits was a small Neolithic flint flake and a fine example of *Helix pomatia*, the mineralized condition of which indicates the presence of a Holocene deposit. In the absence of an open excavation it can only be conjectured that this deposit is the source of the *H. obvoluta* shells. As a Holocene fossil, *H. obvoluta* has been recorded from a hill-wash at Colley Hill, Reigate, associated with *H. pomatia*, *Ena montana* and Neolithic flakes, from a similar deposit at Betchworth, and from Epsom (*J. Conchol.* **22,** 99). For earlier references to *H. obvoluta* at Norbury Park see *J. Conchol.* **5,** 81, **10,** 171, 332. A large number of species was found during the meeting, but with the exception of a single example of *Milax sowerbyi*, all had already been recorded (*J. Conchol.* **21,** 325.)

A. G. D.

Burnham Beeches, Bucks, 22 September 1951. Leader, Mr. A. E. Salisbury. The special object of this meeting was to find out whether *Acanthinula lamellata* still holds its own in the strip of woodland where it was found many years ago by Mr. J. E. Cooper. The snail is confined to a very small patch of ground, but after careful search each member had collected a fair series. Judging from earlier experience of the locality, the population of *A. lamellata* is a good deal less than formerly. A few Zonitidae were seen, but far fewer than might have been expected.

A. E. S.

Chertsey, Surrey, 20 October 1951.—Leader, Miss M. Maitland Howard. The main purpose of this meeting was to collect fossils of *Planorbis acronicus* Férussac and other Mollusca exposed in Otterway's Pit, as a consequence of the removal of the covering earth from old stream beds. These deposits are described in this number of the *Journal*, p. 261. They vary in age from pre-Neolithic to about Roman times. The party also visited the near-by river Thames, which here forms a long and almost cut-off meander. The bed of the modern river was exposed in dumps of dredged material, containing numerous species. The piece of land enclosed by the meander is called Penton Hook. In it an excavation was in progress connected with the opening of a passage from the river to enable barges to be brought to Otterway's Pit. Amongst the debris of this excavation were found quantities of shells, which

Mr. Davis identified as similar to those from the Penton Hook deposit examined by J. E. Cooper (*Proc. Malac. Soc.* **14**, 34). Since the formation of Penton Hook as a slip-off slope must, for reasons of river mechanics, be later than most of the deposits of Otterway's Pit into which the meander is cut, this debris is likely to be younger than the deposits of Otterway's Pit containing *Planorbis acronicus*; hence the shells of this species contained in it may be derived from Otterway's Pit. The site described by Cooper may or may not be identical with the shell-containing debris that was exposed at the time of this field meeting, which contained, besides *P. acronicus*, numerous shells of *Unio pictorum*, *U. tumidus*, *Anodonta cygnea*, *A. minima* and *Viviparus viviparus*. In Otterway's Pit *Viviparus* is absent, and only fragments of *Anodonta* have been found in the later levels. Since all these were listed by Cooper from his Penton Hook deposit, the collections made on 20 October seem, at present, to suggest that Cooper's deposit is later than those of Otterway's Pit. The site is very complex, and needs to be examined by a geologist before an accurate assessment of the situation can be made.

M. M. H.

REVIEW.

A Beginner's Guide to South African Shells. K. H. BARNARD, D.Sc., F.L.S. Pp. 215; 37 plates (5 in colour), 46 text-figures. Cape Town: Maskew Miller, Ltd. (no date nor price).

UNDER a modest title Dr. Barnard has provided the beginner with a much needed popular account of the Mollusca and Brachiopoda of South Africa. The author does not claim to deal with all the species that exist in the area, but by virtue of his position at the South African Museum he has been able to assess what shells are most frequently collected, so that the account presents a very high proportion of the species likely to be found by the average collector. In comparison with popular natural history books published in this country, the text has perhaps been over simplified, but the value of the book lies in the drawings prepared by the author; these are well executed and the beginner should have no difficulty in naming his shells. There are five colour plates, depicting some of the more decorative shells (such as *Pleurotomaria africana*) and the larger opisthobranchs, the latter from living specimens.

An introductory section of 30 pages deals with general structure, the shell, mandibles and radula, and spawning, with notes on making a collection. The book is commendably free from the errors usually found in a popular work. Two may be mentioned here: on p. ii the captions have been reversed, and on p. 42 *Spirula* is said to have a sucking disc at its hind end; this disc is now known to be a light organ (Bruun, 1943, *Dana Rep.* no. 24). These are trifles, and Dr. Barnard's book will be of great value to the growing number of shell collectors in South Africa.

W. J. REES.

OBITUARY.

A. P. GARDINER, 1871–1951.

ALAN POOLE GARDINER, son of Clement Gardiner, was born at Brislington, Bristol, 11 March 1871, and died at his home at Bradfield, Berkshire, 25 January 1951. He came of an old Bristol family; an ancestor, John Gardiner, was Warden of the Society of Merchant Venturers about 1626, and another John Gardiner was High Sheriff of Bristol at the time of the corn riots; Captain Alan Gardiner, R.N., was the founder of Durban. A. P. Gardiner was educated at Brighton House School and University College, Bristol, graduating B.Sc. (London) in 1905. He was for a time lecturer in Biology and demonstrator in Physiology in the laboratory of Sir Ernest Cook, subsequently holding teaching appointments at Alton, Falmouth (1906) and Newbury (1912) grammar schools. He was lecturer in Biology and Chemistry to Cornwall and Hampshire county councils. In 1915 he joined the staff of Bradfield College, where he was senior science master from 1918 till his retirement in 1933; he returned to teach Biology and Chemistry for the period of the war, 1939–1945. "J. D. H." writes in *The Times* (2 February 1951): "It is as a supreme biologist that Gardiner, whose obituary notice was published on January 26, will be remembered at Bradfield. When the Hollowell Prize was endowed in 1918, it was Gardiner who conceived the idea of awarding it to the best exhibit in a many sided Natural History exhibition. He established a tradition of competent enthusiasm, raising the status of the 'bug-hunters' and making it easy for many boys to enjoy those country pursuits, which only a few could enjoy in the days of Collett and Beach Thomas. That the exhibition is now an important annual event, to the encouragement of real research instead of mere collecting, is due as much to Gardiner as to the founder of the prize." Gardiner himself looked upon his organization of the Hollowell Memorial Exhibition as his most important scientific work.

Gardiner married Minnie Gertrude Handcock, daughter of Charles Handcock, in 1899; they had a daughter, Margot Kathleen, who married Thomas Stevens, grandson of the founder of Bradfield College, and a son, Alan A. M. Gardiner, now biology master at Radley College. Mrs. Gardiner died in 1935, and Gardiner married her sister, Edith Georgianna, in 1937.

Gardiner was elected a member of the Conchological Society in 1914, was Recorder of Marine Mollusca from 1931 till his death, and President in 1934. He was a vice-president and member of council of the Malacological Society. Gardiner was interested principally in Mollusca of the littoral zone, which formed the subject of his presidential address (*J. Conchol.* **20**, 65). His researches were particularly directed to the ecology of Mollusca of the sea-shore and estuaries and their association with other organisms. He proposed a new genus and species, *Berthellina engeli* (*J. Conchol.* **20**, 198), but most of his published papers and notes deal with the natural history and distribution of Mollusca. His collection was bequeathed to Oxford University Museum.

Dr. Kathleen White has written the following appreciation : " A. P. Gardiner will long be remembered by his friends as a naturalist, gardener and teacher. As a naturalist his interests were widespread and his knowledge deep. He was an enthusiastic botanist with a great interest in the habitats of the rarer native species, many of which he had collected and reared in their natural environments on his rockery. This rockery, which he loved and tended so well, is consequently very rich in variety, rarity and beauty of species. He was an ardent collector of British shells, and his affection for both animals and plants, correlated with great patience, made him the finest collector I have been privileged to know, and gave him a comprehensive knowledge of British marine Mollusca, as well as of other animals and plants in the field.

" Probably as a teacher ' A. P. G.' was at his best. His charm of manner, enthusiasm and delightful eagerness to share his interests with any of kindred tastes produced one who inspired me and many others to a biological career. The fine standard of the Hollowell Natural History Exhibition at Bradfield College was an indication of this. To know him as a teacher was to love him, and many must be grateful that they were privileged to pass through his hands."

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Papers intended for publication in the *Journal of Conchology* should be sent in the first instance to the Hon. Secretary of the Society.

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A SINISTRAL *PILA* FROM AFRICA.

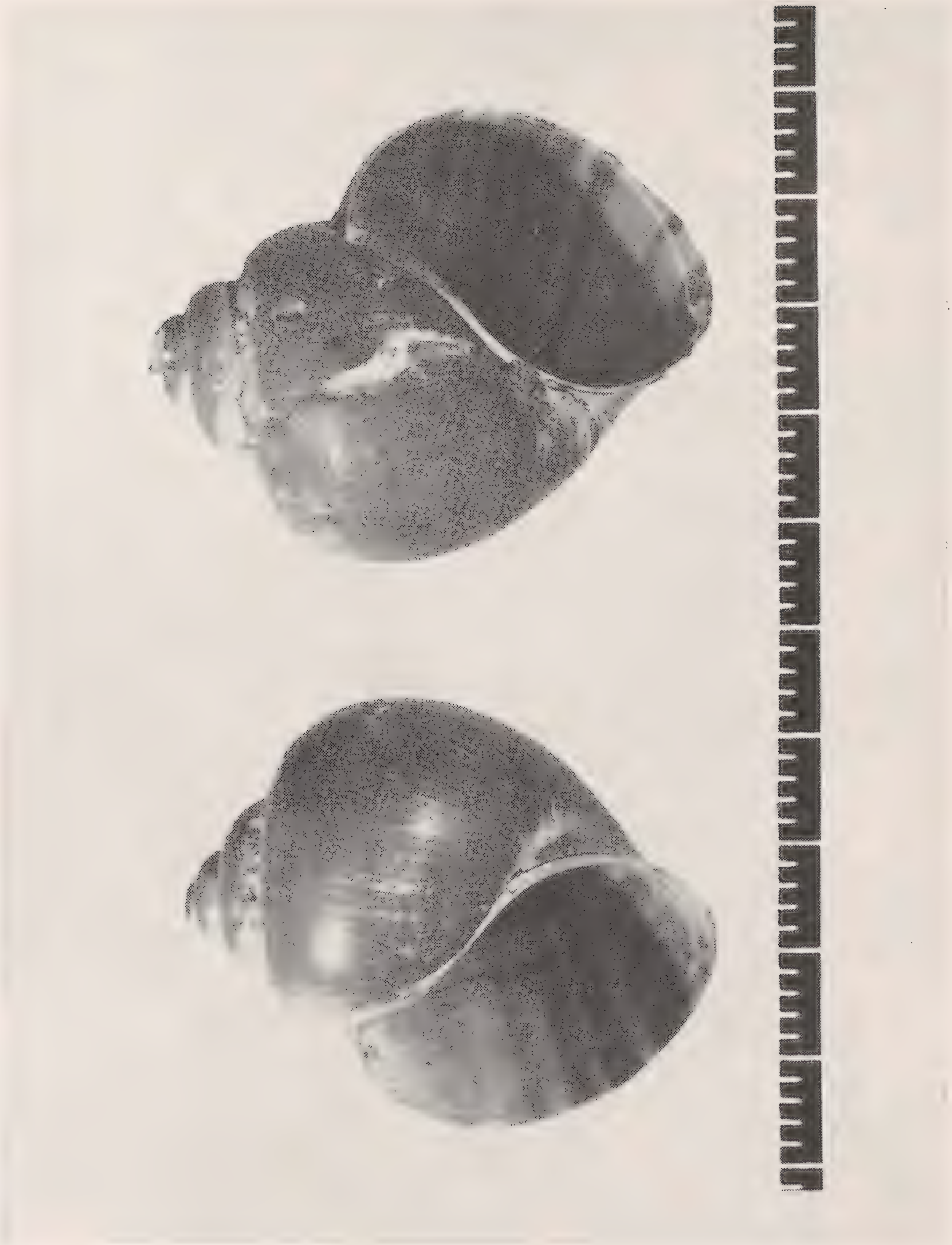
By E. Dartevelle, Dr.Sc.

When one mentions sinistral Pilidae, the use of analytical keys inevitably suggests *Lanistes* Montfort, a genus confined to Africa. It is well known, however, that *Lanistes* is not really a sinistral mollusc, though the shell appears sinistral. Troschel (1845) was, I believe, the first to show that the asymmetrical organs of the body of *Lanistes* are not situated on the left side, in " situs inversus ". Bouvier (1886) came to the same conclusion on considering the nervous system of these Mollusca. According to Pelseneer (1891) the explanation of this anomaly is due to Simroth and von Ihering : these authors suppose that the coiling, which has become re-entrant, has produced an umbilicus as it were turned inside out (hyperstrophic). It should be noted that the operculum cannot supply any criterion in this case, since in *Lanistes* it is not spiral. The question could only be settled by the discovery of a planorboid ancestor of *Lanistes*, at least from the older tertiary beds, since the earliest *Lanistes* are from the Eocene (Wenz, 1923). The American genus *Ceratodes* Guilding must be excluded, since this genus is longosiphonate. It is more reasonable to consider the fossil genus *Pseudoceratodes* Wenz, which contains several African species from the Eocene, some of which have been erroneously included in *Ceratodes* (see Wenz, 1923, p. 2500, and 1938 ; Cox, 1933, p. 330).

One might ask whether truly sinistral Pilidae are known. The answer is in the affirmative, three examples of sinistral *Pila* being known from Asia, while the first sinistral *Pila* from Africa is described in the present note.

Nevill mentions sinistral *Pila globosa* (Swainson) and *P. carinata* (Swainson) from India. In his Catalogue (1877) he records the existence of a single small sinistral specimen of *P. globosa*, found in the Botanic Garden at Calcutta by M. Anderson. In his Hand List (1886, p. 2) he recalls the existence of this specimen, which he calls var. *sinistrorsa*, and reports the finding of a second specimen in the collection of the Asiatic Society of Bengal, the true locality of which is unfortunately unknown, the specimen being labelled " Mauritius ". It should be noted, however, that instances are known of the introduction of Asiatic freshwater Mollusca into Mauritius, e.g. *Viviparus zonatus* Hanley from the " trou d'eau douce ", which is actually *Bellamya bengalensis* (Küster and Kobelt, 1909). Prashad (1925) describes and figures these sinistral *P. globosa*, and writes : " Both specimens are sinistral abnormalities of the typical *P. globosa*, and I do not believe it is right to give these a separate name, even of subvarietal rank," with which I agree. So far as I am aware, no further sinistral *P. globosa* has been reported.

The third sinistral example of Asiatic *Pila* belongs to *P. carinata*. It is mentioned very briefly under the name sub-var. *sinistrorsa* by Nevill (1886, p. 3). The single specimen came from Madras. Strangely, most authors who have worked on the Mollusca of India have omitted this form. Even Alderson (1925), after referring to it in his preface, omits any mention of it in the paragraph dealing with *P. carinata*. Prashad (1925, p. 75) regards *P. carinata* as a synonym of *P. virens* (Lamarck), a view



Pila wernei dewulfi Bequaert & Clench.

with which everyone can agree. He describes and figures the sinistral shell (pl. 14, fig. 3).

So far as I know, no sinistral *Pila* had been found in Africa until I collected a specimen some time ago in the Mayumbe, Belgian Congo. As in the case of the Calcutta specimen of *P. globosa* (the only one for which Nevill gives any details), it is a small individual, corresponding to the description of *Pila dewulfi* Bequaert and Clench (1933), which according to Mr. T. Pain is only a dwarf form of *P. wernei* Philippi. Below will be found the measurements of this sinistral shell, together with those of the type of *P. dewulfi*.

	Shell.		*Aperture.*		
	Height.	*Width.*	*Height.*	*Width.*	*Whorls.*
Sinistral: .	25·9 mm.	20·6 mm.	17 mm.	10·6 mm.	5
Type: .	56 mm.	45 mm.	36 mm.	24 mm.	6

Ratio width/height of shell: sinistral, 0·79; type, 0·8
Ratio width/height of aperture: sinistral, 0·62; type 0·66

It will be seen that the proportions are very similar. The general shape of the shell and of the aperture, whorls and umbilicus, the green colour and the position of the dark bands all correspond closely with the description of *P. dewulfi*. In order to show this to the best advantage, I have figured side by side the sinistral shell and a normal *Pila* of the same size from the same locality. The microsculpture of the shell is identical with that of *P. dewulfi*. Unfortunately I have not been able to find the operculum. This rare and interesting specimen was discovered at Konde li Satchi in the Mayumbe, in a drained marsh together with many hundreds of normal shells. It is now in the Musée du Congo Belge at Tervuren, Belgium (No. 347641). Mr. Bequaert and Mr. Pain have very kindly examined the specimen and both have confirmed the determination.

REFERENCES.

ALDERSON, E. G., 1925. *Studies in Ampullaria.*

BEQUAERT, J., and CLENCH, W. J., 1933. Studies of African land and freshwater mollusks, II. *Rev. Zool. Bot. Afric.* **23**, 2, p. 71, pl. 5.

BOUVIER, E. L., 1886. Sur le système nerveux typique des Prosobranches dextres ou sénestres. *Comptes rend. Acad. Sci.*, Paris, **103**, p. 1276.

COX, L. R., 1933. A lower tertiary siliceous rock from the Anglo-Egyptian Sudan. *Bull. Inst. d'Egypte*, **15**, p. 330.

KÜSTER, H. C., AND KOBELT, W., 1909. Martini and Chemnitz, *Systematischen Conchylien Cabinet*, B.I., Abt. 21, N.F., p. 142, pl. 28, fig. 7.

NEVILL, G., 1877. *Catalogue of Mollusca in the Calcutta Museum*, fasc. E, July, p. 3.

NEVILL, G., 1886. *Hand List of Mollusca in the Calcutta Museum*, pt. 2.

PELSENEER, P., 1891. Sur la dextrosité de certains Gastropodes dits "sénestres". *Soc. Roy. malac. Belg.* **26**, pp. 94–6.

PRASHAD, B., 1925. Revision of the Indian Ampullariidae. *Mem. Ind. Mus.* **8**, No. 2, pp. 73 and 75, pl. 13, figs. 9 and 10, pl. 14, fig. 3.

TROSCHEL, F. H., 1845. Anatomie von *Ampullaria virens* und über die Gattung *Lanistes* Montf. *Archiv. f. Naturgeschichte*, **11**, I, p. 213.

WENZ, W., 1923. *Fossilium Catalogus*, **1**. Animalia, pars 23: Gastropoda extramarina tertiaria, VI, p. 2499 *et seq.* [To this list must be added the species described by Cox (1933, p. 335).]

WENZ, W., 1928. Zur Systematik tertiärer Land- und Süsswasser Gastropoden, VII. *Senckenbergiana*, **10**, 3, 4, p. 121.

EXPLANATION OF PLATE 8.

Pila wernei dewulfi Bequaert and Clench: Sinistral shell, No. 347641, Musée du Congo Belge, Tervuren. Dextral shell, No. 347642. Locality: Konde li Satchi, Mayumbe, Belgian Congo.

FEB 1 1

NOTES ON SOME RECENTLY RECOGNIZED TYPES IN THE BRITISH MUSEUM (NATURAL HISTORY).

Designation of two Lectotypes.

By GUY L. WILKINS.

(Read before the Society, 17 May 1952.)

1. STROMBUS GALEATUS Swainson

Strombus galeatus W. Swainson, 1823, *Philosophical Magazine and Journal*, article 82, pp. 401–2, 31 December.

Strombus crenatus G. B. Sowerby, 1825, *Catalogue of the Tankerville Collection*, No. 1789, appendix p. xix.

Strombus galea W. Wood, 1828, *Index Testaceologicus*, Supplement, p. 14, plate 4, figs. 13 and 14.

As the earlier numbers of the *Philosophical Magazine* are now seldom seen, William Swainson's original English description is repeated below: "Shell large, ventricose, unarmed, transversely grooved, spire very short; outer lip entire, above rounded, dilated, and ascending on the spire. This *Strombus* has long been known to collectors in its young state; but two or three adult specimens have recently been brought to this country from Peru. Its size is nearly equal to *Strombus gigas*, but in appearance it resembles a *Dolium*, the outer lip is dilated only on its upper part. Mr. Broderip is in possession of the finest specimen I have yet seen, and he suggested to me the very appropriate name I have here given it."

From the above description it will be seen that the author did not state the whereabouts of the other specimens noted, so that the Broderip shell, marked with the register number B.784, is the only specimen known definitely to have been examined by Swainson, and may be regarded as the author's original material, and thus eminently suitable for designation as the lectotype of *Strombus galeatus* Swainson.

In view of the statement that Broderip had personally suggested the name, it is curious to note that the shell was apparently labelled *S. crenatus*, and entered as such in Dr. J. E. Gray's manuscript estimate of the Broderip collection, at the time of its purchase by the Museum (1837). Wood figured two specimens of his *S. galea* in the Supplement to his *Index Testaceologicus*, both said to be in the British Museum, but only the original of figure 14, an immature shell from the Cracherode collection (No. 408), received in 1799, has so far been recognized. The resemblance to *Dolium*, noted by Swainson, referred to *Dolium galea* (L.), which is similar in appearance, but not in weight, to *S. galeatus*.

Recorded localities: Acapulco (Cracherode, 1799 mss.); Peru (Swainson, 1823); Valparaiso (Belcher, 1828); Gulf of Nicoya, C. America, "on the reefs at low water" (Cuming, 1830); Panama to Mazatlan (Tryon, 1885); W. Coast C. America (Maxwell-Smith, 1944).

Measurements of lectotype: length 188 mm., width at widest part 153 mm.

2. VERMETUS (SIPHONIUM) MAXIMUS (Sowerby)

Serpula maxima G. B. Sowerby, 1825, *Catalogue of the Tankerville Collection*, No. 23, appendix p. i.

Serpula maxima W. Wood, 1828, *Index Testaceologicus*, Supplement p. 27, plate 8, fig. 2 (as *Vermetus maximus*, p. 58).

Siphonium maximum M. O. Mörch, 1861, Review of the Vermetidae, part 1, *Proc. Zool. Soc.*, p. 166, 23.

Sowerby concluded his short Latin description with the following observations in English :

"Several specimens of this species exist in the collection ; they are attached to, and some of them deeply embedded in coral. It is a very large species, the tubes being almost an inch wide. The aperture in the older shells is round."

Two of the Tankerville specimens are present in the Museum collection, marked 23*a* and 23*d* respectively ; No. 23*a* is the original of Wood's figure 2 on plate 8 of his *Supplement*, and although in miniature and reversed by the engraver, it can readily be recognized by the inclusion of a strongly keeled juvenile, which has attached itself to the outer surface of the fully grown specimen.

Mörch (1861) suggested that the British Museum specimen figured by Wood was probably the very shell of Sowerby's description, but it has been shown above that Sowerby described the Tankerville specimens collectively. The two originals available could perhaps be regarded as syntypes, but as it is uncertain how many examples were actually in the Tankerville collection, it seems preferable to designate the shell figured by Wood in 1828 as the lectotype of *Vermetus maximus* (Sowerby). No locality was received with this shell, but the species is fairly widely distributed.

Recorded localities : Pacific Ocean (Stutchbury, *circa* 1829) ; Island of Ngau, Fiji (McGillivray, *Herald*, 1855) ; Java to Polynesia (Tryon, 1886) ; Great Barrier Reef, Queensland (Yonge, 1929).

Measurement of lectotype : diameter of tube aperture 22 mm. B.M. 1952. 5.14.1

3. VERMETUS (THYLACODES) FUSCATUS (Sowerby)

Serpula colubrina J. F. Bolten, 1798, *Museum Boltenianum*, p. 70, No. 894, *Serpula* species 10.

Serpula fuscata G. B. Sowerby, 1825, *Catalogue of the Tankerville Collection*, No. 22, appendix p. i.

Serpula fuscata W. Wood, 1828, *Index Testaceologicus*, Supplement, p. 27, pl. 8, fig. 3.

V. (*Thylacodes*) *colubrinus* var. *violaceo-fusca* M. O. Mörch, 1862, Review of the Vermetidae (part 3), *Proc. Zool. Soc.*, p. 71, 3.

Sowerby was apparently unaware that Bolten had named this species *Serpula colubrina* in 1798, so that his *fuscata* becomes a synonym of that species, with the Tankerville specimen No. 22 as the holotype.

The shell is in excellent condition and is plainly the original of Wood's figure 3 on plate 8 of the *Supplement* ; as in the previous species, the figure is in miniature and reversed by the engraver. Mörch (1862) realized Sowerby's error in describing this specimen as a new species and proceeded to relegate it to the first of a series of four newly named varieties of Bolten's *colubrina*. Incidentally the phrase chosen by Mörch for this new variety, *violaceo-fusca*, was that used by Sowerby to describe the colour of the Tankerville specimen.

The locality of the holotype is unknown, but the species has been recorded from the Philippines, Borneo and New Caledonia (B.M.).

Measurement of holotype : diameter of tube aperture 20 mm. B.M. 1952.5.14.2.

4. CYMBIUM UMBILICATUM (Broderip)

Melo umbilicatus W. J. Broderip, 1826, in Sowerby, *The Genera of Recent and Fossil Shells*, vol. 2, No. 28, pl. 255.

Melo umbilicatus W. J. Broderip, 1847, in Sowerby, *Thesaurus Conchyliorum*, vol. 1, p. 416, *Melo* sp. 10.

Melo umbilicatus S. Hanley, 1854, *The Conchological Miscellany*, plate 8, fig. 23.

The original description of this species was published in Sowerby's *Genera* prior to Broderip's projected *Species Conchyliorum*, in the first part of which he monographed the genus *Cymba* in 1830, intending to follow this with others on *Melo* and *Voluta*, but after publication of the first part, the work was discontinued. Broderip amassed a large collection of the shells of these three genera, for he believed that accurate knowledge was impossible without adequate material for study, the plates produced from his own specimens of *Cymbium* proving beyond doubt the soundness of this belief. Broderip had prepared the text and plates for the second part of the *Species Conchyliorum*, but these did not appear until some years later, the text being published by Sowerby in 1847 and the plates by Hanley in 1854. Plate 8 of the series dealing with *Melo* in Hanley's *Miscellany* was devoted to two views of the type specimen of Broderip's *M. umbilicatus*, previously figured and designated in 1826. In the legend to plate 9 of his monograph of *Cymbium* in 1860, Lovell Reeve, who regarded the species as a variety of *C. ducale*, erroneously states that " In the specimen of *Cymbium ducale* here figured, we have the original type of Mr. Broderip's *Melo umbilicatus* ", but the shell figured is quite unlike the specimen now known to be the type.

A discussion as to the affinities which undoubtedly exist between *Cymbium umbilicatum*, *ducale* and *diadema* is beyond the scope of these notes, but on shell characters alone there is every reason to believe the Broderip species to be distinct.

Recorded localities : Moreton Bay, New Holland (Broderip, 1826) ; Port Essington (J. B. Jukes, 1847) ; Australia and Indian Ocean (Tryon, 1880) ; Heron Island, Queensland (Allan and Middleton, 1946).

Measurements of holotype : length 190 mm. ; width at the widest part 125 mm. ; protoconch : length 7 mm. ; width 12 mm.

Type specimen said by the author to be an intermediate stage of growth.

5. CYMBIUM MILTONIS (Gray)

Voluta miltonis J. E. Gray, 1834, in *Griffith's Cuvier*, vol. 12, plate 29, Index p. 601.

The specific descriptions attributed to Gray in the "Index to the Figures of Mollusca" (pp. 595–601) in the above quoted volume are extremely brief, but as they conform to all necessary requirements of name, description and figure, their validity cannot be doubted. The description to plate 29 (p. 601 of the Index) reads as follows: "Voluta Miltonis, *Gray*. Pale ash, marbled with brown spots. From New Holland." The figure given, although reduced in size, is excellent, and leaves no doubt that the shell now marked as the holotype is the original. The type specimen is the only one among the nine examples of *C. miltonis* in the Museum collection of which the origin is unknown. Localities and collectors recorded for the other eight specimens are as follows: mouth of the Swan River (G. B. Sowerby MS., 1832); Swan River (Captain Mangles, 1838); New Holland (Captain George Gray, 1840); Swan River-Sharks Bay (Cuming). The species was named by J. E. Gray after Lord Milton, later Earl Fitzwilliam (1786–1857).

Measurements of holotype: length 235 mm.; width at widest part 140 mm.; protoconch: width 14 mm.; height 10 mm. B.M. 1952. 5.13.2.

For a comprehensive list of recently recorded localities and measurements of *C. miltonis*, see Bernard C. Cotton, *Records of the S. Australian Museum*, vol. 5, No. 4, 1936.

6. MUREX REGIUS Swainson.

Murex regius W. Swainson, 1821, *Exotic Conchology*, part 2, plate 15.

Murex regius W. Swainson, 1822, in *Bligh Catalogue*, p. 16, lot 201 (*sic* 221), locality "Peru".

Murex regius W. Wood, 1828, *Index Testaceologicus*, Supplement p. 15, plate 5, fig. 13.

Murex regius Schubert and Wagner, 1829, in Martini and Chemnitz, *Neues Syst. Conch. Cab.* vol. 12, p. 133, plate 230, figs 4066 and 4067 (*non* Swainson).

Murex regius J. Mawe, 1832, in Wodarch's *Introduction to Conchology*, 4th ed., frontispiece, fig. 2, p. 109.

Murex regius W. Swainson, 1834, *Exotic Conchology*, 2nd issue, part 2, plate 15.

Murex regius S. Hanley, 1841, *Exotic Conchology*, 2nd ed., p. 6, pl. 15.

This fine South American shell does not seem to have claimed the attention of authors until Swainson's name and figures published in 1821. The scarcity of the first and second issues of *Exotic Conchology* may account for later authors attributing the name to W. Wood, who reproduced a miniature figure of the species in his *Supplement* of 1828, but there seems little reason for the error, as Wood clearly referred the species to part 2 of *Exotic Conchology*.

The shell now recognized as the holotype of *Murex regius* Swainson was in the Broderip collection, as stated in the legend to the finely executed plate, and was found to be one of a series of four Broderip specimens attached to the same tablet in the Museum collection; the type bears the Broderip number 770, and was registered in 1837. The colouring of the original plate is identical with the type, the lip of the shell being a much paler pink than is usual for the species, but in the second issue and second edition of *Exotic Conchology*, the colouring of the plate is usually stronger, thus losing some of the original delicacy of the earlier figures.

It should be mentioned here that some difficulty was experienced when checking the species with Sherborn's *Index Animalium*, for it appears that this is one of the few instances where a reference was overlooked by that tireless worker; the only *Murex regius* recorded by him was that of Schubert and Wagner quoted above. The shell figured by these authors is *M. erythrostomus* Swainson, 1831 [= *M. bicolor* Valenciennes, 1832]; Swainson's name of course takes priority, but can only be regarded as a *nom. nov.* for Schubert and Wagner's preoccupied *M. regius*.

Recorded localities: Peru (Swainson, 1822); Panama (Cuming, in B.M.); Acapulco, Mexico, to Peru (Maxwell-Smith, 1944).

Measurements of holotype: length 80 mm; width at widest part 68 mm.

A SINISTRAL *VIVIPARUS VIVIPARUS* (L.).

By A. G. Davis.

(*Read before the Society*, 19 *January* 1952.)

Sinistrality among post-Pliocene non-marine Mollusca is rare (Kennard, *Proc. Malac. Soc.*, **15**, 258), and the discovery of a sinistral example of *Viviparus viviparus* (L.) is here recorded. The specimen is a juvenile of not more than two and a half whorls with part of the base of the shell missing, and was found with an abundant fauna in fifteenth to seventeenth century debris exposed in the excavations for the Festival of Britain site at South Bank, London, 1949. The deposits were described by Ainsley (*London Naturalist* **29**, 39), Davis (*ibid.*, 40), and Davis and Carreck (*ibid*, **30**, 30). The shell was found in bed "e" (Ainsley), i.e. 6 feet below the surface, a few yards from the base of the Shot Tower.

About a dozen normal shells of *V. viviparus*, mainly juveniles, were also found. The following species were in association: *Theodoxus fluviatilis*, *Valvata piscinalis*, *Bithynia tentaculata* and *Lymnaea peregra* in some abundance, while of more rare occurrence were *Lymnaea truncatula*, *L. palustris*, *Planorbis acronicus*, *Segmentina complanata*, *Discus rotundatus*, *Hygromia hispida*, *Sphaerium rivicola*, *S. corneum*, *Pisidium amnicum* and *Pisidium* spp. undetermined.

Records of British living sinistral *Viviparus* are rare, and the following references have been brought together with the kind assistance of Mr. J. R. le B. Tomlin.

V. viviparus (L.): Bardsley canal (*J. Conchol.* **10**, 148), and a juvenile at York (*J. Conchol.* **22**, 170; *Naturalist*, 1946, 34).

V. fasciatus (Müller): Beswick reservoir, Lancashire, 1862, a fine example from which six young escaped, one of which was also sinistral (*J. Conchol.* **12**, 68).

A NOTE ON THE DISTRIBUTION OF *ANODONTA CYGNEA* (L.) HAVING REGARD TO DIFFERENCES IN SEX AND GILL-STRUCTURE.—III.

By H. H. Bloomer.

(*Read before the Society*, 15 *December*, 1951.)

On 16 July 1951 Mr. G. W. Pitchford sent to me a live specimen of *A. cygnea* from the Grantham canal near Gamston, Nottinghamshire, not far from where the canal is connected with the River Trent. It seems to have been an isolated mussel, as no more live ones could be found in the vicinity, only empty shells. The shell, 199 mm., is an elongate form of the typical form of *A. cygnea.* The animal is a male. The smears taken from the antero-dorsal, central and ventral parts of the gonads show numerous sperm-morulae in different stages of development and a few spermatozoa. The lamellae of the outer gills are close together and the interlamellar septa are narrow and irregularly situated so that the outer gills have a non-marsupial appearance.

On 29 July Mr. Pitchford forwarded to me two samples of *A. cygnea* collected from other sections of the canal. The first sample, consisting of four individuals, was gathered near Model Farm, where the bottom of the canal is more of the nature of grey clay than mud. Three, 137, 151 and 142 mm., disclose in their smears only a few ova and the male products are very scanty or not clearly defined. In the smear of the fourth one, 101 mm., are a small number of ova, numerous sperm-morulae and very few spermatozoa. All the four individuals have marsupial outer gills.

The second sample of five individuals was collected from the canal, where there is a depth of black mud, and in the neighbourhood of Wollaton Colliery. The smears of three, 95, 87 and 98 mm., show some, not many ova, and though there is evidence of male products in each case, the noticeable feature is the unripened condition of the gonads so late as the end of July. All three have marsupial outer gills. The last two are males, the shell of one, 91 mm., near var. *zellensis* Gmelin, and the other, 113 mm., is a very elongate form of typical *A. cygnea.* The smears of the former reveal numerous sperm-morulae in different developmental stages and not many spermatozoa, whilst in the smears of the latter the sperm-morulae are not so plentiful and spermatozoa are scarce. The outer gills of both individuals are similar to those of the 16th July mussel, but in several parts of them there is an indication of modification in their structure. All the other shells vary in shape from an elongate form of typical *A. cygnea* to var. *zellensis.* The fish in the canal are pike, tench, bream, perch, roach, minnow and stickleback.

The finding of three males in nine individuals appears to be a high proportion in comparison with the pool " Lawn ", but the more interesting question arises, is the sex-phase of *A. cygnea* in the River Trent the same as that in the Grantham canal ? That question at present remains unanswered.

Mr. Pitchford also sent a nice sample of *A. cygnea* from the beck, Urswick Tarn, North Lancashire, in the Furness district about seven miles from Barrow-in-Furness. Urswick Tarn, which is approximately 600 yards long by 400 yards wide, has the village of Great Urswick situated around the northern part. From the southern end the tarn outflows by a beck that eventually enters Morecambe Bay. It is a very slowly flowing stream, normally clear, but the sediment is easily disturbed, then the water becomes turbid. Shortly after leaving the tarn the beck is 10 to 15 feet wide and 6 inches to over 1 foot deep, and for 100 yards on the right and 250 yards on the left side of its bed the mussels were found in abundance: along this stretch the sample was gathered. The bottom of the beck has a good depth of red mud: the colour is due to the haematite which occurs mainly in pockets in the carboniferous limestone, and through that region this part of the beck and tarn drain. The fish in the tarn are trout, roach, bream, eel and stickleback, and in the beck there is a quantity of aquatic vegetation.

The sample of eleven live mussels was collected on 10 September 1951 and examined between 12 and 19 September. The shells vary a little in shape from near the typical to a more elongate form, and they measure from 102 to 138, the average being 119 mm. All the individuals had the outer gills more or less filled with glochidia, with the glochidial shell chiefly in the earlier stages of formation. The smears taken from the antero-dorsal part of the gonads of all the individuals show relict ova, mostly small, relatively few in number and not any mature ones. Moreover, there is even a greater scarcity of male products, and in the smears of two individuals alone are sperm-morulae definitely recognizable and in those of five only can spermatozoa be detected with certainty.

I am grateful to Mr. Pitchford for his continued help in the research, and for the information concerning the localities where the samples were taken.

Penton Hook Fauna—In the account of the Field Meeting of 20 October 1951 (*J .Conchol.* 23, 283) *Anodonta cygnea* appears in the faunal list as the result of a misunderstanding. It was not included in the original MS., nor has it been found in the deposit in question.

M. M. HOWARD.

THE SHELLS OF PAINSWICK: BIBLIOGRAPHICAL NOTE.

By A. G. Davis.

(*Read before the Society*, 19 *January*, 1952.)

In the *Painswick Magazine* for 1889 there appeared during the months of January to July an article in serial form entitled "The Shells of Painswick" by Cecil T. Davis. This quarto publication bears no pagination; the title page bears the imprint of W. Judd, St. John's Lane, Gloucester; the magazine was issued monthly as a church magazine, price 2*d*. The article covers about eight pages and as a local Gloucestershire list has escaped bibliographers. The writer has been unable to obtain any information about the author and there is no reference to him in Charles Upton's records (*Proc. Cotteswold Nat. F.C.*, 1911, **17**, 1917, **19** and 1919, **20**). Probably Mr. Davis ploughed a lonely furrow and was content with publishing the results of his snail hunting in the parish magazine. He records 28 species from Painswick, Glos.:—

Arion ater, *A. hortensis*.

Limax agrestis, "dew snail," *L. maximus*, *L. flavus*.

Helix pomatia, rare in the parish, more plentiful outside; Cranham, Birdlip and Whitcombe Woods, Miserdine.

H. aspersa, *H. nemoralis*, *H. hortensis*, the last two species fine and variable.

H. arbustorum, Edge and Sheepscombe lanes.

H. virgata, *H. caperata* and *H. ericetorum*, abundant on the slopes of Painswick Hill.

H. lapicida, *H. rufescens*, common.

Bulimus montanus, abundant in woods and Leckhampton parish.

B. obscurus.

Pupa secale, very common, hills round Painswick.

Pupa edentula, woods and Painswick churchyard.

P. umbilicata, woods and hedgerows.

Balia perversa, Frith Woods.

Clausilia rugosa and *C. laminata*, woods.

Cochlicopa tridens, *Zua lubrica*, abundant Painswick Hill.

Achatina acicula, Painswick Hill (Paul L. Smith).

Carychium minimum, *Cyclostoma elegans*, on the oolite only.

A GIANT EAST AFRICAN *ACHATINA.*

By T. Pain.

(*Read before the Society*, 15 *March* 1952.)

Amongst a small series of land shells from Mbanja, Lindi River district, in S.E. Tanganyika Territory, collected in 1945 and recently placed in my hands for identification, occurred several specimens of *Achatina* (*Lissachatina*) *reticulata* Pfeiffer, one of which is of such unusual size, even for this large species, as to be worthy of being placed on record. The dimensions (in millimetres) of this shell are as follows: height 209, width 94; aperture 96 × 50. Seven and a half whorls remain, the apex being decollate. Bequaert (1950) gives the measurements of a number of specimens, the largest of which has nine and two-thirds whorls and is 208 mm. in height; it is also from near Lindi. The type described by Pfeiffer (1845) was only 160 mm. in height.

It is unfortunate that the nepionic whorls of this giant specimen are missing, as it must originally have attained a length of something like 215 mm. The shell is very heavy and ponderous, the outer lip greatly thickened. The periostracum is completely lost, as is usual in adults of this species.

Achatina reticulata is extremely abundant on coral limestone in Zanzibar and southern Tanganyika Territory.

References.

Bequaert, J. C., 1950. Studies in the Achatininae, a group of African land snails. *Bull. Mus. Comp. Zool. Harvard* **105**, No. 1, p. 132, pl. 9, fig. 4, pl. 16, fig. 2, pl. 63, fig. 4, pl. 66, fig. 1, pl. 67, fig. 1, pl. 71, fig. 4.

Pfeiffer, L., 1845. *Proc. Zool. Soc. Lond.*, p. 74.

HELIX POMATIA L. AT CARSHALTON, SURREY.

By G. I. Crawford.

(*Read before the Society*, 18 *October* 1952.)

On 2 June 1952, in the evening after a wet day, I found some 16 specimens of *Helix pomatia* L. on a patch of rough chalky ground half a mile south of Carshalton Beeches station. Most of the snails were crawling on heaps of rubbish cast out from neighbouring gardens. The majority appeared to be full grown, but at least two earlier age groups were represented. On the evening of 8 June, in rain, I saw 34 *H. pomatia*, some laying eggs. On 12 June, in dry weather, I with difficulty found two snails, and dug up a batch of 30 eggs from a spot where I had marked a snail going down on 8 June. On 15 June, after a wet day, the snails were again active and egg laying was in progress.

This record may be of interest, since the locality is so near to London (about 11 miles from Charing Cross). I do not feel certain that the colony is a genuine relic of a natural fauna; the snails may have been introduced in recent times, but whatever their origin, they are now well established.

OBITUARY.

HARRY OVERTON, 1875–1951.

ANOTHER name has gone from our list of Life Members by the death of Harry Overton on 7 October 1951; he joined the Conchological Society in 1896, becoming a life member in 1917.

Overton was born at Walsall, Staffs, in 1875 and was the son of Mathers Overton of that town. Early in Overton's boyhood his father moved with his family to Sutton Coldfield, where Overton spent his schooldays at Bishop Vesey's Grammar School. Most of his life was spent at Sutton Coldfield, where after training in the accountancy office of Mr. John Lewis of Birmingham and having to put in some extra hard work in order to qualify owing to the death, during this period, of his father, he practised as a Chartered Accountant until his retirement in 1945. He and his wife then moved to Bognor, Sussex, where he died.

On leaving Sutton Coldfield he presented his shell collection to the Birmingham City Museum and Art Gallery.

Overton was a member of several societies interested in Natural History, Archaeology, Photography and like subjects and as a later interest in less active years he amassed a fine collection of postage stamps.

Overton was greatly interested in the colour photography of colour variations of Mollusca, and exhibited some remarkable results at meetings of the Conchological Society; he was also very successful in colour photography of land and seascapes and made some delightful pictures during a holiday with his wife in the Mediterranean.

Overton married in 1908 and his wife survives him.

A. E. SALISBURY.

REVIEW.

The Shell Book. A popular Guide to a knowledge of the families of living mollusks, and an aid to the identification of shells native and foreign. JULIA ELLEN ROGERS. pp. xxi, 503; 95 plates (8 in colour). Boston, Mass. Charles T. Branford Co., 1951. 52*s*. (Sole agents, Bailey Bros. and Swinfen, Ltd., 26–27 Hatton Garden, E.C. 1.)

IT is not always pleasant to meet an old friend in a new guise, but the new edition of *The Shell Book*, once the too blatant dust-jacket has been removed, is found to be as excellent as the last, both in production and contents. The book opens with a comprehensive chapter on " How to know shells " followed by practical hints on collecting and the maintenance of marine and freshwater aquaria, also the " snailery " or vivarium. The rest of the book is divided into parts, dealing systematically with the various classes of the Mollusca, based on the arrangement of Tryon and Pilsbry in " The Manual of Conchology ", which, although not up-to-date, may still be regarded as a standard authority.

In the obvious interests of economy the text has been reproduced by a photographic method, so that the nomenclature in the text is that obtaining at the time of the first edition (1908), but this drawback is compensated for by a list of every name used in the book, printed side-by-side with its modern counterpart, if changed. This list has been prepared, with introductory notes, by Dr. H. A. Rehder of the Smithsonian Institution. The older names still remain on the plates, but here again the illustration index has been considerably amplified and revised by Dr. Rehder.

The plates, of which several have been replaced with more modern photographs, exhibit a wide range of marine, land and freshwater species, particular attention being paid to those of economic importance. There is one fault which might have been put right in the revised nomenclature list; there are far too many abbreviations of authors' names, and it seems scarcely fair to expect the beginner, for whom the book is mainly intended, to gather that " Cpr." is intended for Carpenter or " A.Ads." for A.Adams, and so on. Apart from this defect, the author and publishers are to be congratulated on the issue, at a comparatively moderate price, of a book which, although dealing with a preponderance of American shells, cannot fail to attract the beginner, and even the more advanced student of the Mollusca, in many parts of the world.

G. L. WILKINS.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

709th Meeting, held at the British Museum (Natural History), 19 January 1952.

The President in the chair.

Election of Members.

N. W. Gardner, 7 Jubilee Avenue, Devonport, Auckland, New Zealand.

Bruce Wilfred Sparks, M.A., Department of Geography, Downing Place, Cambridge.

Communications.

" The Shells of Painswick " and " A sinistral *Viviparus viviparus* (L.)," by A. G. Davis.

" A sinistral specimen of an African *Pila*," by Dr. E. Dartevelle.

Exhibits.

Special exhibits: *Nucella* and *Hygromia.*

The President: Variations in *Nucella lapillus.*

Rev. H. E. J. Biggs: British *Hygromia.*

Mr. C. P. Castell: British recent, Pleistocene and Pliocene *Hygromia*, and *Nucella tetragona* from the British Museum collections.

Mr. A. G. Davis: British *Hygromia* and exhibits to illustrate his papers.

Mr. A. E. Ellis: European *Hygromia* and allied species.

Mr. T. Pain: *Achatina achatina* (L.), *A. bicarinata* (Brug.), *Strophocheilus oblongus* (Müller) and S. *popelairianus* (Nyst), with eggs.

Dr. H. E. Quick: Dissections and drawings of genitalia of British species of *Hygromia.*

Dr. W. J. Rees: *Tetranychoteuthis dussumieri* from the stomach of a sperm whale, Azores; *Sthenoteuthis bartrami* and *Onychoteuthis banksi*, *Discovery* Expedition.

710th (Special General) Meeting held at the British Museum (Natural History), 16 February 1952.

The President in the chair.

At the request of the President, all present stood as a mark of respect to the memory of H.M. King George VI.

The President, on behalf of the Council, then presented to the Meeting the amended Rules of the Society, which were unanimously approved and adopted. (A copy of the revised Rules was inserted in vol. 23, no. 8, issued on 6 March.)

711th (Annual) Meeting, held at the British Museum (Natural History), 16 February 1952.

The President in the chair.

Election of Member.

C. B. Kay, B.Sc., R.A.F., Batham Gate, Bradwell, *via* Sheffield.

Election of Scrutineers.

Rev. H. E. J. Biggs and Mr. H. H. Shephard were elected Scrutineers.

Election of Auditors.

Miss M. Maitland Howard and Mr. G. L. Wilkins were elected auditors for 1952.

Statement of Accounts.

The Hon. Treasurer presented the audited accounts for the year 1951, which were adopted.

Annual Reports.

The reports of the Council, Yorkshire Branch, and Recorders were presented and adopted.

Votes of Thanks.

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permitting the Society to hold its meetings in the Museum; to the authorities of the Leeds Museum for housing the Society's library and cabinets; and to the Officers and Members of Council for their work on behalf of the Society.

Presidential Address.

The President delivered an address on "Wood and stone boring Mollusca", illustrated by lantern slides and specimens.

Election of Officers and Council.

The Officers and Council were declared elected as printed on the ballot paper (see page 287).

Exhibits.

Rev. H. E. J. Biggs: *Helix hortensis* var. *lurida* Moq., Yaxley, Suffolk.

Mr. A. G. Davis: A 15th Century jug from the base of the deposit at Penton Hook, containing shells of Unionidae and other Mollusca.

Miss M. M. Howard: Land shells from Morocco.

Mrs. E. M. Morehouse: *Xenophora corrugata*, off Hen and Chicken Islands, New Zealand.

Mr. T. Pain: *Pomacea gigas* (Spix), R. Merañon, near Iquitos, Peru (the largest freshwater gastropod).

Mr. G. W. Pitchford: American Naiades.

Report of the Council.

During 1951 the increase in membership has been maintained, the total now standing at 180 ordinary and 2 honorary members, a gain of 12 during the year. Eight ordinary meetings, the annual and a special general meeting have been held at the British Museum (Natural History), by kind permission of the Trustees. The average attendance at meetings continues to increase. Seven field meetings, two in conjunction with other societies, were held in the London area and continued to prove popular.

Donations to the library include a valuable gift from Mr. F. M. Dyke of works by Chemin, Crampton, Dautzenberg, Favre, Germain, Hornell, Pelseneer, Pilsbry, Suter and Vayssière; the first three parts of *Nuova Revisione della Conchiglie marine di Sicilia*, by Dr. O. Priolo, presented by the author; and *A Beginner's Guide to South African Shells*, by Dr. K. H. Barnard, presented by the author.

Three numbers of the *Journal of Conchology* were published during the year, namely vol. 23, no. 5, 5 March, and a double number, 6 and 7, 24 October, being the 7th edition of the Society's "Census of the distribution of British non-marine Mollusca". The Society's thanks are due to the Recorder for the preparation of the new edition of the Census and to all members who have co-operated and contributed records. The publication of the Census was rendered possible by the transference of £100 from the Research Fund and by a grant of £50 from the Government Publications Fund administered by the Royal Society; donations amounting to £8 were received from Dr. K. H. Barnard, Mr. A. E. Ellis, Mr. E. A. Ellis and Mrs. B. J. Paton.

Report of the Yorkshire Branch.

The year opened with a lecture by Mrs. E. M. Morehouse on "The larger British Helicidae", illustrated by slides and specimens. On 10 February Mrs. N. F. McMillan gave an address, illustrated by specimens, on her work on the estuarine and brackish water Mollusca of the Dee and Mersey estuaries. In March Mr. A. Smith delivered his presidential address, in which he traced the history of the river Foss and conchological changes in that waterway, concluding with a summary of the present day distribution of each species.

Although attendance at excursions was lower than last year, conditions were better and more specimens were taken. On 23 June fourteen species were collected at Boston Spa and Bramham Cross-roads. The excursion to Scarthingwell Hall was cancelled, as the Hall has now become a convent and further investigation of the lake there prohibited. In the river Foss, York, eight species were recorded on 14 July. In September fifteen species were taken at Wentbridge and Smeaton.

At the meeting held on 13 October Mr. A. Smith was re-elected President. On 10 November Mr. S. G. Appleyard gave a lecture entitled "A study of *Lymnaea peregra* and *Hydrobia jenkinsi* in four ponds at Temple Newsam, Leeds", covering a two-year survey of the distribution and habits of these species in widely differing ponds. The membership at the end of the year was 21 ordinary and 5 honorary members.

S. G. Appleyard (*Hon. Sec.*).

Recorder's Report: Non-marine Mollusca.

Very few new records have been received this year. It is hoped that the publication of a new edition of the Census will stimulate collectors to fill up the gaps, particularly in the distribution of critical or recently recognized species.

Cornwall West (1): *Lauria anglica*, Newtrain Bay, Padstow, A.E.E.

Cornwall East (2): *Phytia myosotis*, *Planorbis laevis*, *Vallonia excentrica*, Landulph, near Saltash, Rev. J. H. Adams.

Dorset (9): *Truncatellina cylindrica*, "Dorsetshire," R. Damon, det. H. Watson.

Kent West (16): *Cochlicopa minima*, Biggin Hill, K. J. Fox; *Laciniaria biplicata*, Deptford Creek, Pickering collection.

Surrey (17): *Abida secale*, Hackhurst Downs, Gomshall, H. H. Shephard.

Berkshire (22): *Oxychilus draparnaldi*, Reading, H. E. Quick.

Montgomery (47): *Balea perversa*, Machynlleth, H. H. Shephard.

Durham (66): *Truncatellina cylindrica*, Claxheugh-on-Wear, Mason collection, det. H. Watson.

Perth Mid (88): *Pisidium conventus*, Loch Choin, *circa* 1,200 ft., near Pitlochry, K. A. Pyefinch, det. A. E. E. and A. W. Stelfox.

Perth East (89): *Pisidium hibernicum*, Loch Dunmore, Faskally House, Pitlochry, K. A. Pyefinch, det. A. W. Stelfox.

Fermanagh (120): *Potamopyrgus jenkinsi*, Lough Erne, near Ely Lodge, T. T. Macan.

Aliens: *Helicella cespitum* (Draparnaud), Sherborne, Dorset, G. K. Gude (Kennard collection); *Theba pisana*, Hampton Hill, Middlesex, C. N. Bromehead, 1904 (Kennard collection); *Helix lactea*, Dover, Kent, Mason collection.

Corrections to the Census, 7th edition: p. 182, insert subgenus ARMIGER Hartmann before *P. crista*; p. 190, *Helix hortensis*, Butleyan (not Waltonian) Crag: see Harmer, *Pliocene Mollusca of Great Britain*, **1**, 17; p. 197, insert subgenus PSEUDANODONTA Bourguignat before *A. minima*; p. 200, *Physastra dispar* (Sowerby): the author of the genus was inadvertently cited after the specific name; p. 186, *Vertigo lilljeborgi*: Mr. B. W. Sparks reported (*in litt.*) the occurrence of this species in the

Pleistocene at Barrington, but has since come to the conclusion that the shells "are probably no more than slightly inflated *V. parcedentata*". (*Geol. Mag.* **89**, 173.)

A. E. E.

712th Meeting, held at the British Museum (Natural History), 15 March 1952.

The President in the chair.

Election of Members.

Barry Colville, 4 Grove Avenue, Gosforth, Newcastle-upon-Tyne 3.
Sydney George Appleyard, 29 Berkeley Mount, Leeds 8.

Communications.

"A new species of Aviculiformes from South Africa," by H. J. Koch.
"A giant East African *Achatina*," by T. Pain.

Exhibits.

Special exhibit: *Cardium* and freshwater Prosobranchia.

The President: Operculum of *Theodoxus fluviatilis*, Holocene, Penton Hook; *T. fluviatilis*, rivers Thames and Lea; *T. cantianus*, Pleistocene, Swanscombe; *Viviparus fasciatus*, Oxford canal.

Mr. A. E. Ellis: European freshwater Prosobranchia.

Mr. T. Pain: Type species of genera and subgenera of Pilidae.

Mr. G. W. Pitchford: British and foreign freshwater Prosobranchia; *Cardium procerum*, Gulf of California; *Lymnaea peregra* eaten by *Dytiscus marginalis*, showing how the body-whorl is broken open; *Handbook of illustrated Shells in natural colors, from Japanese islands and their adjacent territories*, by Shintaro Hirase, revised by Isao Taki.

Mr. L. W. Stratton: British and New Zealand freshwater Prosobranchia; New Zealand boring Mollusca.

Mr. G. L. Wilkins: Species of *Cardium* from the Norman collection.

713th Meeting, held at the British Museum (Natural History), 19 April 1952.

The President in the chair.

Election of Member.

Mrs. F. G. Kellett, 613 Royal Palace Hotel, London, W. 8.

Exhibits.

Special exhibits: *Pterocera*, land Prosobranchia.

The President: Living *Theba pisana*, Rush, Co. Dublin.

Major R. J. Griffiths: Series of *Pterocera* and *Strombus*.

Mr. T. Pain: World-wide Cyclophoridae showing variation in form.

Dr. H. E. Quick: Albino *Azeca goodalli* and *Acme fusca*; melanistic *Agriolimax reticulatus*; land Prosobranchia from Jamaica and Pacific islands.

Mr. G. L. Wilkins: *Pterocera* from the British Museum collections.

714th Meeting, held at the British Museum (Natural History), 17 May 1952.

The President in the chair.

Communications.

"Cypraeidae at Akaba, Jordan," by Major R. J. Griffiths.

Notes on "*Cypraea lutea* Deshayes" and "*Mactra ornata* Gray", by A. E. Salisbury.

"Notes on some recently recognized molluscan types in the British Museum," by G. L. Wilkins.

Exhibits.

Special exhibits: *Cypraea*; British non-marine aliens.

The President: Living *Abida secale*, Arundel Park, Sussex; *Pisidium* spp. from sealed ditch of Brigantine fort, Stanwick, Yorks (lowest layer A.D. 79); shells of *Testacella haliotidea* and *T. scutulum*, St. Paul's churchyard, London, 1913, and *T. scutulum*, Catford, Kent, 1902, coll. B. T. Lowne.

Mr. C. P. Castell: Introduced aliens from the Kennard collection.

Mr. A. E. Ellis: *Margaritifera margaritifera* and *Anodonta anatina*, R. Wye, Hereford; examples of most of the alien non-marine Mollusca recorded from the British Isles.

Major R. J. Griffiths: *Cypraea* from Akaba and Seychelles.

Mr. T. Pain: *Placostylus* from Lord Howe Island; *Rumina decollata* from a greenhouse at Bristol, M. K. Connolly, 1900.

Mr. G. W. Pitchford: North American Unionidae collected by H. D. and D. R. Athearn; *Euhadra* from Japan, collected by Professor Masao Azuma.

Mr. A. E. Salisbury: Specimens to illustrate his communications.

Mr. G. L. Wilkins: Specimens to illustrate his communication.

LIST OF MEMBERS.

Changes of Address.

COMFORT, DR. A., 44 The Avenue, Loughton, Essex.

COXHEAD, P., 12 Cambridge Square, London, W. 2.

CURNOW, P. W., Grant Institute of Geology, West Mains Road, Edinburgh 9.

DE BARTOLOMÉ, J. F. M., Ranmoor Residential Chambers, 405 Fulwood Road, Sheffield 10.

PAIN, T., 16 Landseer Buildings, Millbank, London, S.W. 1.

RICHARDSON, D. N., Flat 3, Risholme Court, Crockham Hill, Edenbridge, Kent.

WATERSTON, A. R., O.B.E., F.R.S.E., Royal Scottish Museum, Edinburgh 1.

Resignations.

G. I. CRAWFORD, DAY KIMBALL.

Members Deceased.

J. E. COOPER, E. H. SOLLY.

THE TWO BRITISH SPECIES OF *CARYCHIUM*

By Hugh Watson and Bernard Verdcourt.

(*Read before the Society*, 18 *October* 1952.)

[Plates 9 and 10.]

The minute snails belonging to the genus *Carychium* are probably among the oldest and most primitive of living Pulmonata; and although they are still widely distributed throughout the greater part of the Northern Hemisphere, until recently most authors have believed that only a single species now lived in the British Isles, namely, *Carychium minimum* Müller (1774), the type of the genus. This was the view, for example, expressed in the well-known works of Forbes and Hanley (1852), J. G. Jeffreys (1862), L. Reeve (1863), L. E. Adams (1884 and 1896), Kennard and Woodward (1926) and A. E. Ellis (1926). Adams, however, in the second edition of his book, mentioned also a variety *tridentata* (Risso), and so did Ellis, but they both merely described it as having the denticles rather more pronounced than in the typical *C. minimum.*

The same forms of *Carychium* occur commonly in the neighbouring countries on the Continent of Europe, and many Continental writers—such as Moquin-Tandon (1856) in France, Steenberg (1911) in Denmark, Geyer (1927) in Germany and Mell (1937) in Austria—agree with the British authors just mentioned in regarding the form that was named *Saraphia tridentata* by Risso in 1826 as not more than a variety of *Carychium minimum*, if they mention it at all. Others, however, have pointed out that Risso's form differs from *C. minimum* not only in having, as a rule, slightly stouter denticles in the aperture, but much more in the longer and narrower shape of the shell, and in usually living in woods and other places which are not so wet as the marshes in which *C. minimum* itself is most frequently found. These authors, accordingly, have often regarded *C. tridentatum* (Risso) as a distinct species.

So long ago as 1839 Anton separated the two forms specifically, calling the narrower one *Auricula* (*Carychium*) *nanum* Küster; but when Küster himself described and figured both forms in 1841 he reduced *nanum* to a variety of *C. minimum.* In the same year, however, A. and J. B. Villa again separated them specifically, but described the narrower form as a new species, naming it *Carychium elongatum.* In 1857 Bourguignat, when monographing the genus *Carychium*, employed the older name *tridentatum* (Risso) for the narrower species, as he said that, although Risso's description of *Saraphia tridentata* was far from perfect, his species could not be anything else than that which the brothers Villa named *C. elongatum* and Anton and Küster *C. nanum.* Subsequent writers who have separated the species have therefore nearly always preferred to use the name *C. tridentatum* (Risso) for the narrower woodland form, which Bourguignat had no doubt was specifically distinct from *C. minimum* Müller.

In accordance with his custom Bourguignat distinguished a number of other species, two of which, *C. striolatum* Bgt. and *C. rayianum* Bgt., might well occur in England, as he discovered them in the French department of Aube. Through the kindness of Dr. Mermod of Geneva it has been possible to examine Bourguignat's original specimens of these supposed species. *C. striolatum* was said to be near *C. tridentatum*, but to differ from it in the shell being strongly striated instead of smooth, as well as in some other minor details. But *C. tridentatum* is only smooth when the shell is worn ; when in good condition it is striated, as is apparent from specimens labelled *C. tridentatum* in Bourguignat's own collection, and his specimens labelled *C. striolatum* from Ville-au-Bois, Aube, and from near Paris agree closely with well preserved examples of *C. tridentatum* both in their sculpture and in their other features. On the other hand a single rather worn specimen of *C. rayianum* in Bourguignat's collection, from Villechatif (near Troyes), the type locality, closely resembles *C. minimum*, except that the tooth within the outer lip is but little developed, and other similarly labelled shells in better condition from Lepuy, Ht. Loire, seem to be quite identical with *C. minimum* itself. Therefore, although Locard (1894) described four species of *Carychium* as still living in France, namely *C. minimum* Müll., *C. tridentatum* (Risso), *C. striolatum* Bgt. and *C. rayianum* Bgt., it is evident that Germain (1913 and 1931) and others were right in uniting *C. striolatum* with *C. tridentatum* and *C. rayianum* with *C. minimum*, thus reducing the number to two. But Germain had no doubt that *C. tridentatum* and *C. minimum* were quite distinct species ; and although Clessin was still doubtful in 1884, when the second edition of his work on German Mollusca appeared, he became convinced that they were specifically distinct before he wrote his work on the Mollusca of Switzerland, Austria and Hungary soon afterwards.

It was not until 1925, however, that Zimmermann published his important paper showing that, while there were no statistical grounds for separating *Carychium striolatum* from *C. tridentatum*, there were good grounds for separating the latter species from *C. minimum*. He measured hundreds of specimens from numerous localities, most of them in Austria and the surrounding countries, and found that in each of the localities where *C. minimum* alone seemed to be present the average ratio of the shell's height to its breadth was between about 1·77 and 1·93, whereas in each place where only *C. tridentatum* appeared to occur it was between about 2·05 and 2·2. In the few cases in which the average ratio was between 1·93 and 2·05 a mixture of the two species was probably present. He also pointed out that in *C. tridentatum* the whorls are more ventricose than in *C. minimum*, although the whole shell is narrower. He recorded both species from England, as well as from Central Europe ; but it happened that the very few collections that he examined from the north of the Continent consisted only of *C. minimum*, which was originally described from Denmark ; and the few he examined from south of the Alps consisted only of *C. tridentatum*, originally described from the French Riviera, and of one or two other species sometimes confused with *C. minimum* but which he considered to be distinct from it.[1] More than one subsequent Continental author has accordingly affirmed that *C. tridentatum* was mainly a southern species and *C. minimum* a northern one, although in Central Europe their areas of distribution overlapped. In reality, however, both species are widely distributed in Europe, from Sweden southwards to Corsica and Spain. *C. tridentatum* seems also to live in Algeria, but whether *C. minimum* likewise extends into Africa is more doubtful, the Algerian specimens in Bourguignat's collection that most nearly resemble it perhaps belonging to other closely related species, such as *C. nouleti* Bgt., which also occurs fossil in the south of France. But *C. minimum* extends eastwards into the north of Persia, judging from specimens belonging to the Museum at Basle, although in that region *C. tridentatum* is largely (though not entirely) replaced by its near ally *C. lederi* Bttg.

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[1] Such as *C. mariæ* Paulucci, a small, strongly striated form from the South Tyrol and North Italy, and *C. paganettii* Zimmermann, a larger, nearly smooth form from Calabria and Sicily.

Carychium minimum and *C. tridentatum* are both very common in the neighbourhood of Geneva, the latter species being especially abundant in the older Post-Glacial deposits of the Geneva basin; and in 1927 Favre, in his valuable work on the Holocene and Recent Mollusca of that region, also strongly supported the view that these two forms were distinct species. He emphasized the fact that, while *C. minimum* chiefly frequents stagnant marshes, *C. tridentatum* lives mainly in woods and meadows; and that although both species might sometimes be found living together on the banks of streams, he had observed no intermediate forms in such places. Among the very numerous specimens left by water-courses a few doubtful shells might occur, but they were much too rare to justify uniting the two species.

Since the writings of Zimmermann and Favre became known most authors have agreed that *Carychium minimum* and *C. tridentatum* are almost certainly distinct species. This view has been adopted, for example, not only by Germain (1931) in France, but also by Mermod (1930) in Switzerland, Ehrmann (1933) in Germany and Mandahl-Barth (1949 and 1951) in Denmark, and by some of the best British authorities, such as Kennard in his later papers, and Ellis (1941) and Quick (1943) in their Presidential Addresses to this Society. Nevertheless not everyone has been able to accept this opinion. Although both forms are common in Denmark, Thorson and Tuxen (1930) after measuring many Danish specimens, which their tables clearly show were of both types, did not think that there was sufficient evidence to prove that they belonged to more than one species, *C. minimum.* They supposed that if *C. tridentatum* were specifically distinct it was probably confined to the south of Europe. Dr. Mell (1937) examined numerous specimens of both types from the neighbourhood of Salzburg in the Austrian Alps, and gave a table of the average measurements of shells from twelve different localities, the nature of which he described. He maintained that the two extremes of *C. minimum* and *C. tridentatum* were connected by a series of intermediate forms, the variation being correlated with the amount of moisture in the place where they were found. The drier the habitat the narrower the shell becomes and the further it departs from the type of *C. minimum*, which frequents wet meadows. One such wet situation he said was made drier by drainage, with the result that most of the specimens of *Carychium* that survived were changed from the *minimum* to the *tridentatum* type. He therefore concluded that the two forms belonged to a single species that varied greatly with the environment.

This view requires consideration. In the less marshy places where *C. tridentatum* is chiefly found we may suppose that the soft tissues of the animal, such as the glandular margin of the mantle that secretes the shell, will be less swollen with moisture than in the very wet habitat of *C. minimum*. This may lead to the whorls tending to expand less rapidly, making the shell somewhat narrower, its aperture smaller, the folds within the peristome rather more pronounced, and the striæ on the shell slightly closer and less flattened out. It is therefore not surprising that in relatively dry places these characteristics of *C. tridentatum* tend to become more pronounced. This tendency may also be observed in Britain. Thus, in specimens of this species collected by Fred Taylor in the relatively dry habitat of some chalk quarries at Purfleet, Essex, in September 1937, the average ratio of the height to the major diameter of the shell is about 2·165, whereas in others collected by D. K. Kevan in a damp habitat at the head of Loch Long, Arrochar, Dunbarton, in July 1930, it is only about 1·97.

But if this were the cause of the difference between *C. minimum* and *C. tridentatum*, it is evident that in habitats intermediate in humidity, where both forms may often be found living together, the majority of the specimens would be more or less intermediate between them in character. And this is very far from being the case. We have seen that Favre stated in 1927 that he had observed no intermediate specimens between the two forms in places where they lived together near Geneva, and there is normally a similar scarcity of any intermediate forms where they live together in the British Isles. For example, in England one of us collected 24 specimens in October 1947, in a small area of Ampthill Marsh, Bedfordshire, and, on examination, 14 of them proved to be undoubted examples of *C. minimum* and 10 of *C. tridentatum*, not one intermediate shell being found. In Scotland the specimens of *C. tridentatum* mentioned above, collected by D. K. Kevan at the head of Loch Long, were accompanied by a few specimens of *C. minimum* (with an average ratio of 1·81), all of which contrasted with them rather strongly, no intermediate shells being found, notwithstanding that the specimens of *C. tridentatum* from that place were shorter than usual. In Ireland Kevan collected 73 specimens in November 1930, in marshy ground at Mountmellick, Queen's Co. (Leix), of which 43 proved to be *C. minimum* and 30 *C. tridentatum* (see pl. 9, figs. 4 and 5) ; and again we saw no intermediate shells.

Although *C. minimum* and *C. tridentatum* are most often found in separate places, many other instances could be given of localities, both in the British Isles and in various Continental countries, where the two forms live together under the same conditions without grading into each other, showing that their differences in character cannot be caused by differences in the environment. Only occasionally do we find a very few doubtful specimens from localities where at least one of the species is unusually variable and the condition of some of the specimens is too poor to allow all the differential characters to be clearly seen. For example, about 3 specimens in poor condition proved to be doubtful among about 50 (including both forms) collected by Mr. and Mrs. Thurgood in June 1934, in Plessey Woods on the banks of the River Blyth in Northumberland. But when large numbers of shells belonging to variable closely allied species from numerous localities are individually examined, it is unusual not to find among them any doubtful specimens whatever, even when the distinctness of the species is never disputed.

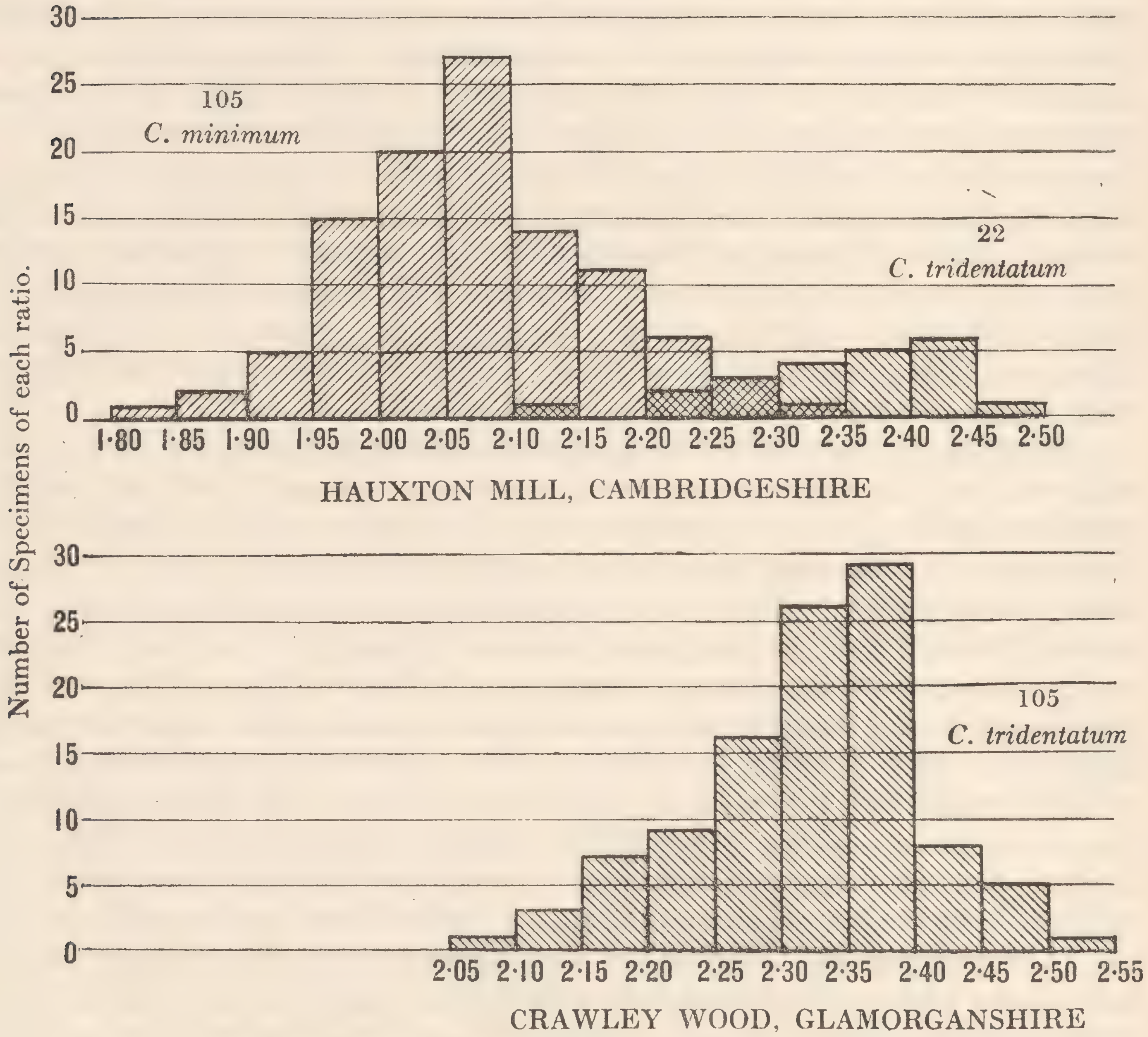
Undoubtedly, however, *C. minimum* generally thrives better in wet habitats and *C. tridentatum* is somewhat drier places, and therefore where the two species are found together, the drier the locality the larger the number of *C. tridentatum* we should expect to find there, and the smaller the number of *C. minimum.* Accordingly, if the average measurements, etc., of all the specimens of *Carychium* from each of a number of localities where both species occurred were to be tabulated, we should expect the results to form a graduated series approximately correlated with the amount of moisture in each place. And if a part of a wet area was made drier by drainage, *C. minimum* would naturally be the first to disappear from that spot, being gradually replaced by *C. tridentatum* until the ground became too dry even for it to survive there. These considerations may explain Dr. Mell's observations on the specimens from the neighbourhood of Salzburg, for his conclusions seem to be largely based on the average measurements of all the shells he found in each locality, without regard to the fact that in many places both species may be mixed together. That they do occur together in that neighbourhood is confirmed by the fact that three out of four collections from places near Salzburg that were lent to us by Dr. Schlesch contained mixtures of the two species in different proportions, although this had apparently not been noticed by the collectors of the specimens. Frequently one kind of snail is adapted to a drier habitat than another, but this does not imply that the two forms are not distinct species ; generally they are.

Moreover, the differences between *C. minimum* and *C. tridentatum* are normally so considerable that if they had been caused by the environment it would have meant that these little snails become modified to an exceptional extent by the conditions under which they live. And this does not seem to be the case. For although unusual conditions of the environment may sometimes cause local departures from the normal in either species, yet specimens of each, living in places as widely separated and with such different climates as Sweden and Spain, Ireland and Croatia, are often so like one another that it would be impossible to distinguish them if they were mixed. Their chief specific differences seem to remain constant throughout Europe, as well as in specimens of Pleistocene and Holocene age.

It has also been suggested that *C. tridentatum* might be simply an hereditary mutation of *C. minimum.* In snails in which self-fertilization may take place it is difficult to test this view by any conclusive breeding experiments, but how very improbable it is will be realized when it is remembered that such intraspecific mutations usually effect only a single character of the snail, or more rarely a small group of linked characters, whereas *C. tridentatum* normally differs from *C. minimum* in several diverse features. In fact the differences between these two forms are no less than we commonly find between distinct, but closely allied species. Had these two members of the genus *Carychium* been as large as, for example, the two British species of *Viviparus*, there can be little doubt that they would have been generally recognized as distinct species for a century or more. But as they were so very small, the older writers, especially in England, failed to notice that their differences were of more than varietal importance, and collectors, relying on these authors' books, have been long in discovering that they were mistaken. Probably, however, the chief reason why *C. minimum* and *C. tridentatum* have been, and often still are, confused with each other, is the absence of any good figures or descriptions in English works showing how the species differ. Even in the books of French and German authors who recognize the two forms as distinct species the illustrations of them usually leave much to be desired, although those in Mandahl-Barth's recently published Danish works are better. It is hoped, however, that the figures accompanying the present paper will help British collectors to see how the two species differ, and that the following notes on their chief differences will further assist them to separate one from the other.

Dimensions.—The most conspicuous difference between *Carychium minimum* and *C. tridentatum* is that the latter species is on an average considerably longer and narrower and more cylindrical or turreted in form than *C. minimum*, which has a relatively broader and more oval shell. This difference can be more clearly seen by the eye than by measurements of the ratio of the height to the major diameter of the shell, because in *C. tridentatum* the greater convexity of the whorls and the usually broader peristome slightly increase the measurement of the major diameter. The effect of the broader peristome can be avoided by measuring instead in both species the minor diameter across the first half of the last whorl just above the aperture ; but this also slightly reduces the real difference between the two species, because in *C. minimum* the last whorl normally enlarges rather more rapidly than in *C. tridentatum*, so that the second half of the last whorl is relatively slightly broader in the former species than in the latter. Nevertheless the following graphs show that the ratio of the shell's height to its minor diameter above the aperture is markedly different in the two species, although both vary so much that, while remaining distinguishable in other ways, the extremes of their variation in this respect may overlap (see pl. 9). The graphs also show that this difference between the species may be as great when they occur in the same locality as when they are found 180 miles apart, the average dimensions of the specimens measured being as follows :—

		A, mean height.	*B, mean minor diam.*	*Mean ratio of A to B.*
Hauxton Mill, Cambridgeshire (H. W.)	*C. minimum*	1·79 mm.	0·87 mm.	2·06
	C. tridentatum	1·90 ,,	0·81 ,,	2·35
Crawley Wood, Gower, Glamorganshire (H. E. Q.)	*C. tridentatum*	1·95 ,,	0·84 ,,	2·32



Ratio of height to minor diameter of shell.

Even if we measure the major diameter, including the expansion of the peristome, instead of the minor diameter, so as to render the results comparable with those given by other writers, the difference in the mean ratio is significant. This will be seen from Table 1, which is based on the measurements of 203 specimens from fifteen other diverse localities in England, Scotland and Ireland, five where only *C. minimum* is found, five where *C. tridentatum* occurs alone, and five more where they both occur together. Nine to twenty specimens were measured from each locality, being usually selected from a larger number in such a way as to represent as closely as possible the average dimensions of all the

TABLE 1.

	Carychium minimum.			*Carychium tridentatum.*		
	A, mean height in mm.	*B, mean major diameter in mm.*	*Mean ratio of A to B.*	*A, mean height in mm.*	*B, mean major diameter in mm.*	*Mean ratio of A to B.*
Tremarthenick, W. Cornwall	1·76	0·93	1·89	1·82	0·89	2·05
Milton-on-Stour, Dorset	1·86	0·98	1·90			
Zeals, S. Wiltshire				1·93	0·90	2·15
Norbury Park, Dorking, Surrey				1·95	0·90	2·16
Hadley Woods, Middlesex				2·04	0·99	2·05
Surlingham, E. Norfolk	1·70	0·89	1·91			
Forge Valley, N.E. Yorkshire	1·72	0·94	1·83	1·75	0·84	2·08
Romiley, Cheshire	1·76	0·94	1·88	1·79	0·82	2·03
Holden Clough, Parkbridge, nr. Oldham, S. Lancashire	1·70	0·91	1·87	1·76	0·85	2·08
Grange-over-Sands, N. Lancashire	1·72	0·90	1·90			
Lakeside Wood, Windermere, N. Lancashire	1·74	0·92	1·89			
Bilston Glen, Rosslyn, Mid-Lothian				1·89	0·90	2·10
Canna Island, N. Ebudes, Argyll	1·62	0·91	1·77			
Mountmellick, Queen's County	1·67	0·90	1·86	1·76	0·84	2·09
Inniscarra, Mid Cork				1·89	0·93	2·04

adult shells, both large and small, collected in each place. It will be observed that the mean ratio of the height to the major diameter of *C. tridentatum* in these ten localities is in all cases between the extremes of 1·97 (in specimens from Arrochar, Loch Long) and 2·165 (in specimens from Purfleet, Essex) already mentioned on page 309, and is always greater than that of *C. minimum*, which varies from 1·77 to 1·91 in the ten places in which this species occurs. Almost the only geographical correlation that the measurements suggest is that both species seem to be slightly shorter in the West of Scotland than elsewhere. But as a rule there is,

TABLE 2.

	Carychium minimum.			*Carychium tridentatum.*		
	A, mean height in mm.	*B, mean major diameter in mm.*	*Mean ratio of A to B.*	*A, mean height in mm.*	*B, mean major diameter in mm.*	*Mean ratio of A to B.*
Längsele, Ångermanland, Sweden				1·99	0·93	2·14
Medelpad, Lo station, Sweden	1·73	0·91	1·89			
Verrières (alluvium of R. Seine) near Troyes, Aube, France	1·82	0·94	1·93	1·90	0·86	2·21
Troinex, near Geneva, Switzerland	1·58	0·83	1·89			
Petit Salève, near Geneva, Switzerland				1·84	0·86	2·14
Schwöll, near Strasswalchen, Salzburg, Austria	1·82	0·95	1·91	1·80	0·84	2·14
Kostel Ravine, near Krapina, Croatia, Yugoslavia	1·73	0·89	1·94	1·76	0·82	2·15
Florence, Italy				1·99	0·90	2·21
Granada (alluvium of R. Darro), Spain	1·69	0·89	1·90			

in either species, much less variation in the mean measurements of specimens from different places than in the measurements of different individuals from the same locality.

For comparison Table 2 shows the approximate mean dimensions of shells, measured in exactly the same way, from widely separated localities on the Continent of Europe. The specimens of each species were collected in six different countries, in three cases together with the other species and in three alone. Although the climatic conditions in these localities show much diversity, and all except one are far from the British Isles, it will be seen that the mean ratio of the height to the major diameter of the shell differs very little from that found in the British specimens, thus confirming the evidence tabulated by Zimmermann (1925) and Thorson and Tuxen (1930). On an average, the difference between the ratios of the two species is quite as great, although in both forms the ratio tends to be slightly higher in some parts of the Continent than in the British Isles, possibly owing to the drier Continental summers. Nevertheless it is remarkable that the mean measurements of specimens of *C. minimum* from places as far apart as Medelpad in central Sweden and Grenada in southern Spain should in both cases be almost identical with those of specimens from Grange-over-Sands, North Lancashire.

Before the shells were measured, all the other characters of these and numerous additional specimens, both British and foreign, were carefully examined and the specific identity of every specimen was thus first made certain. Most authors dealing with the differences between the two species have devoted too little attention to these other characters that separate the two forms, apart from their dimensions ; yet some of them, though not so conspicuous, are of no less systematic importance. We must therefore now consider them.

Whorls.—Both species vary in the exact number of whorls they possess, but as a rule fully grown specimens of *Carychium tridentatum* have a half or two-thirds of a whorl more than specimens of *C. minimum* of about the same size, the average number of whorls in the latter species being about 4·5 and in *C. tridentatum* about 5·1. Only rarely do we find long specimens of *C. minimum* with the same number of whorls as unusually short examples of *C. tridentatum* ; and occasionally adult specimens of *C. minimum*, such as some of those from Canna Island, Argyll, may have as few as 4 whorls, and exceptionally long specimens of *C. tridentatum* nearly 6.

The individual whorls are well rounded in *C. tridentatum* and separated by a rather deep suture, whereas in *C. minimum* they are usually less convex and tend to be slightly flattened laterally, as may be seen from plate 9. The penultimate whorl is generally larger in *C. tridentatum* than in *C. minimum*, and often stands out prominently (compare figs. 4 and 5). The last whorl, on the other hand, is nearly always relatively smaller in *C. tridentatum*, its height, measured from the suture on the left side to the base, being on an average about 52·5 per cent of the total height of the shell in this species and about 60 per cent in *C. minimum*. This feature, however, varies considerably in both species, as may be seen by comparing figs. 2 and 3, or 6 and 7.

Sculpture and Colour.—In both species all the whorls below the protoconch are covered, in well preserved shells, with numerous, nearly vertical, fine striæ, often crossed by a few weak and ill-defined spiral striæ or grooves. But in both forms the striation is more pronounced in some specimens than in others. As a rule, however, the striæ are more raised, more regular and a little closer together in *C. tridentatum* than they are in *C. minimum*, in which species they tend, in most localities, to be somewhat weaker and more rounded, less regular and slightly further apart. This feature makes the shell of the latter species to be usually more glossy and transparent than that of *C. tridentatum*, in which it is not quite so transparent and has a more silky sheen when in good condition. The shell of *C. minimum* is also sometimes not quite so light in colour as that of *C. tridentatum*, but this may be due partly to its usually greater transparency, and partly, perhaps, to its marshy habitats more often containing some peat that may slightly stain the shell.

Aperture and Outer Lip.—In *Carychium tridentatum* the aperture is somewhat smaller and shorter than it is in *C. minimum.* Its height, when measured internally, is on an average little more than a quarter of the height of the shell, whereas in *C. minimum* it is approximately a third of the shell's height. The broadening of the upper part of the aperture above the denticle on the outer lip is often rather less marked than it is in *C. minimum*, so that the outer lip is often a little less oblique. Moreover, in fully grown specimens of *C. tridentatum* the lip is broadly expanded and its inner part well thickened, this part being frequently marked off from the thinner expanded part by a shallow groove. The denticle within the outer lip is also usually thick and bluntly prominent. In *C. minimum* the lip is sometimes almost as thick and broadly expanded as in *C. tridentatum*, especially perhaps in richly calcareous habitats, where the striation may also be stronger than it usually is in this species. As a rule, however, even in fully grown specimens, the lip of *C. minimum* is not so broad as it is in *C. tridentatum*, nor is its inner part quite so thick, and the denticle is often not quite so stout but is more triangular in form, though this is a rather variable feature.

Parietal and Columellar Folds.—The species of *Carychium* are often said to have three denticles in the aperture, but while the projection within the outer lip is a true denticle or tubercle which is not formed until the shell is quite fully grown, those on the parietal and columellar lips are the somewhat thickened ends of spiral folds which may be seen also in young shells. The parietal fold is usually slightly thicker in *C. tridentatum* than in *C. minimum*, but seldom projects quite so far across the aperture as it often does in the latter species. The columellar fold is smaller than the parietal one in both species, but it is usually more prominent in *C. tridentatum* than in *C. minimum.* The differences between the folds of the two species, as seen within their apertures, are, however, so small and inconstant that they have scarcely any systematic value. Far more important are the much greater differences in these folds within the first half of the last whorl.

As is usual in the Ellobiidæ, the inner partitions of the upper half of the shell become absorbed and are absent from adult specimens, a point noted by Jeffreys in 1869, but those of the last 1½ whorls remain. If they are examined it will be seen that in *C. tridentatum* the parietal fold, as it enters the last whorl from above, gradually becomes much broader and its edge curves upwards and becomes much thickened. After passing about 0·2 mm. to the left the thickened edge curves abruptly downwards, becoming almost vertical, as shown in plate 10, fig. 4. It then curves slightly to the left and gradually becomes thinner again, and the fold passes spirally round the second half of the last whorl, narrowing as it does so, until it finally again enlarges to form the so-called parietal denticle in the aperture. This remarkable elaboration of the parietal fold in the upper part of the last whorl is constant in numerous recent specimens of *C. tridentatum* we have examined from many parts of the British Isles and from several Continental countries, and also occurs in English Pleistocene shells. It usually occupies about the position shown in our drawing, but occasionally it may develop slightly earlier, the main thickening and contortions of the fold's edge being then more nearly above the right half of the aperture than the left. On the other hand, in *C. minimum* the corresponding modification of the parietal fold usually takes place a little later, towards the left side of the shell, and is not so prominent—the fold is not so broadened, and its edge does not become so thick and is much less sinuous. It thus has a very different appearance in this species when viewed from the front, as may be seen from plate 10, fig. 3.

If the outer wall of the first half of the last whorl of the shell be broken away to expose the folds within, care should be taken in the case of *C. tridentatum* not accidentally to break off the outer edge of the contorted parietal fold lying just beneath the outer wall, because what will then be left of the fold may have a misleading resemblance to the form of the unbroken parietal fold of *C. minimum.* Fortunately, however, if the shell is empty and in good condition the fold can be seen through the shell's outer wall without breaking it. Photographs, even if taken without the aid of X-rays, may show the folds quite distinctly (compare figs. 2 and 5 on pl. 9). The greater prominence of the fold in *C. tridentatum* fully compensates for the fact that the shell in this species is usually not so transparent as that of *C. minimum.*

The lower or columellar fold in *C. tridentatum* is also somewhat broadened and thickened at the edge in the first half of the last whorl, but only to a very small extent as may be seen from the drawing (plate 10, fig. 4); whereas in *C. minimum* it does not seem to be enlarged at all but remains narrow and thin (plate 10, fig. 3). But the form of this fold before it reaches the aperture is more difficult to see than is that of the upper or parietal fold, and the specific difference which it shows is less striking.

External features of Animal.—We have observed no difference between the species in respect of the outward appearance of that part of the animal which emerges from the shell when the snail is active. This has been figured and described by several authors, including Forbes and Hanley (1852) and Jeffreys (1862) in England, and also L. E. Adams (1900), who pointed out that Jeffrey's drawing was not quite accurate. In both species the skin is unpigmented, excepting the dark eyes, which are situated at the inner bases of the rather short, bluntly pointed tentacles. The foot-sole is not transversely divided by a deep groove into two portions, as it is in many of the marine Ellobiidæ.

The kidney can often be seen through the shell, passing round a large part of the last whorl from the region of the pericardium practically to the mantle-edge. In *C. tridentatum* it usually forms a long and rather narrow band, becoming somewhat broader at the front end. In *C. minimum* it generally seems to be slightly shorter, and to be more pointed at the hinder end but still broader in front. The shape of the kidney, however, depends largely on the degree of contraction of the animal in the specimens examined.

Radula.—The differences between the radulæ of the two species are very small. In both forms the average size of the radula when flattened out is about 0·3 mm. long by 0·1 mm. broad, though the length varies between about 0·26 mm. and 0·37 mm. The breadth is less variable. In both species there are about 100 nearly straight transverse rows of approximately 37 or 39 teeth, with very small cusps. The central tooth in each row has a small mesocone, only 0·001 mm. in length, with a minute ectocone on each side of it. The breadth of the anterior end of the tooth is only about 0·0015 mm.; but the relatively large basal plate increases to about 0·004 mm. in breadth as it passes backwards (see plate 10, figs. 1 and 2). The first 10 or 11 lateral teeth are also tricuspid, each having a mesocone increasing in length from about 0·0013 mm. to 0·0015 mm., flanked by a minute endocone on the inner side and an almost equally minute ectocone on the outer side. Their elongated basal plates slope obliquely backwards on each side, measuring about 0·005 mm. long by 0·0016 mm. broad. In the remaining teeth the ectocone at first divides into two and later into four or five minute denticles in the outer marginal teeth, the mesocone becomes much smaller until it is no larger than the endocone and these minute ectocones, and the whole tooth becomes fully twice as broad as are the inner laterals, with a basal plate of only about half the length of theirs.

The radula of *C. tridentatum* seems to differ slightly from that of *C. minimum* in that the basal plates of the central and lateral teeth are usually not quite so long, that of the central tooth broadening rather more rapidly and those of the laterals being a little more oblique, although a similar appearance can be produced in *C. minimum* if the teeth are slightly tilted backwards. The drawings also show that in the latter species the transverse rows of teeth may be slightly angled in the middle, the top of the central tooth projecting a little further forward than the lateral teeth on each side of it, whereas in the specimen of *C. tridentatum* the rows are straighter; but this slight difference does not appear to be constant.

It may be seen that the radula of English specimens of *Carychium minimum* is very similar to that figured by Odhner (1925), who rightly placed *Carychium* among those genera of the Ellobiidæ which have retained ectocones, although it has become specialized by the reduction in the length of the cusps of the teeth. This, however, is probably connected with the minute size of these snails, a parallel reduction of the cusps being found in such genera as *Punctum* and *Columella* among the Stylommatophora ; and in some other ways, such as its undivided foot-sole, *Carychium* is more primitive than those marine Ellobiidæ in which the teeth have not lost their ectocones.

The reproductive system and some of the other internal organs of *Carychium* were described many years ago by Moquin-Tandon (1856) and Lehmann (1873), and are now being more adequately studied by J. E. Morton in England and H. W. Harry in the United States, whose results, when published, should together throw much light on the anatomy and physiology of the genus. It will therefore be sufficient to state here that most of the organs of *Carychium* seem to be of a comparatively primitive and simple type, and that it is extremely unlikely that any internal specific differences between *C. tridentatum* and *C. minimum* are not too small and difficult to observe to be of any practical use to a collector in separating the two species.

Habitats and Distribution.—The species of *Carychium* occur abundantly throughout Great Britain, and also in Ireland (see Fogerty (1910)—who found 217 specimens in a single handful of drift from near Limerick—and Stelfox (1911)) ; and, like most snails, they are especially common in calcareous districts, although not confined to them. *C. minimum* chiefly lives in marshes and other wet places, in company with such forms as *Vallonia pulchella* (Müll.), *Zonitoides nitidus* (Müll.), *Agriolimax lævis* (Müll.) and *Succinea putris* (L.). On the other hand, *C. tridentatum* is usually found among dead leaves in woods of beech and other deciduous trees, especially in places that are damp but not so wet as those in which *C. minimum* is more often found. It also occurs, however, amongst coarse grass and other herbage, and it is not uncommon to find both species living together in varying proportions near the edges of rivers, ponds, or marshes, and in other places of a more or less intermediate character.

Owing to the difference between their most usual habitats, *C. tridentatum* seems to be the commoner of the two species in counties which are hilly or undulating and well wooded, whereas *C. minimum* appears to be the commoner in open fenland or in districts where there are many marshes or bogs, although both species probably occur in every part of the British Isles. It is the same abroad : in Holland *C. minimum* is much the more abundant species, although *C. tridentatum* also occurs in that country, as was pointed out by Schlesch (1947) ; whereas in many parts of Switzerland it seems to be the latter species that is the commoner form. But the two species have been differentiated from each other since Pleistocene if not still earlier times, and they are probably now both to be found in every country in Europe in which the conditions are favourable.

Seeing that many collectors have confused or misidentified the species of *Carychium*,[1] it may be well to mention that through the kindness of the friends and correspondents named on p. 322 we have been able personally to examine and make sure of the identity of specimens of both *C. minimum* and *C. tridentatum* not only from numerous English localities, ranging from Northumberland and East Norfolk to West Cornwall, but also from North and South Wales, from the Lowlands and Highlands of Scotland, from various Irish localities, ranging westwards to Galway in the case of both species, and from Spain, northern and southern France, Corsica, Switzerland, Germany, Belgium, Holland, Denmark, Sweden (whence we have seen both species from further north than 62°), Latvia, Lithuania, Austria, Yugoslavia, Transylvania and northern Persia. From each of these countries or areas we have seen examples of both the species, and we have also examined specimens of *C. minimum* from Poland and almost certainly from Anatolia and Sicily, and of *C. tridentatum* from Madeira, Algeria, Italy and Moldavia, and probably from Bulgaria. We have also seen specimens of other species of *Carychium* from the Mediterranean Region and beyond, but not from northern, central, or western Europe, with the exception of fossil shells. Nevertheless, as the other species seldom differ more conspicuously than do *C. minimum* and *C. tridentatum*, we cannot be sure that not one of them now lives anywhere in the British Isles but has been overlooked or confused with the two common species by collectors.

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[1] Even Thiele (1931) figured *C. tridentatum* as *C. minimum* in his well-known Handbook.

Varieties.—Apart from the normal forms of *Carychium minimum* and *C. tridentatum*, only two varieties worthy of distinct names seem yet to have been found in the British Isles : *C. minimum* var. *inflata*, a particularly short broadly oval form figured on pl. 9, fig. 3, and *C. tridentatum* var. *elongata*, a very long slender form, depicted in fig. 7.

As regards the first of these, Hartmann, in his book on Swiss Gastropods (1840–4), gave the name *Auricella inflata* to a form found at Rheineck and Staad, which he considered to be at least a distinct variety if not a separate species, but which he only described by saying that it stood between *Auricella carychium* (= *Carychium minimum*) and *A. spelæum*, a broad species with a shorter spire now placed in *Zospeum*, a related genus of little blind snails from caves in Yugoslavia. Hartmann's collections are preserved in the Natural History Museum at St. Gallen, and through the kindness of Dr. Saxer we have seen many specimens of *Carychium* from Staad and Rheineck belonging to that Museum and labelled *inflata* possibly by Hartmann himself. These consisted of a mixture of shells, ranging from broad examples of *C. minimum* to unusually long and slender specimens of *C. tridentatum*, those belonging to the latter species being much more numerous than those belonging to the former. Obviously, however, Hartmann cannot have intended to apply his name *inflata* to the specimens of *C. tridentatum*, and in 1857 Bourguignat definitely restricted this name of Hartmann to the variety of *C. minimum* which he described as being more ventricose than the typical form with a broad peristome. In 1864 Mörch recorded Hartmann's form from Denmark, and similarly described it under *C. minimum* as "var. 1. ventricosior", and since then its occurrence in that country has been confirmed ; while in 1865 Colbeau recorded what seems to be the same form from Belgium at Arlon (with the typical form), but named it var. *curtum.* We have ourselves seen this variety not only from the British Isles, both Pleistocene and Recent,—the specimen figured is from Cambridgeshire—but also from Dalmatia. Clearly, therefore, it is widely distributed, but where it occurs it is seldom abundant and is usually associated with the typical form of *C. minimum.*

As regards the variety of *C. tridentatum* mentioned above, Baldwin, in 1909, briefly described a particularly long and slender form, which he had found at Chatburn in South Lancashire (near the left bank of the Ribble close to the borders of West Yorkshire) and which he named *Carychium minimum* var. *elongatum* nov. Apparently he did not know that so long ago as 1841 A. and J. B. Villa had given the name *Carychium elongatum* to a long form of six whorls from Lombardy, which they described but did not figure. It is probable, however, that the brothers Villa had the same variety before them as Baldwin, the elongated form of *C. tridentatum* being commoner in the south of Europe than it is in England. They gave the size of their *C. elongatum* as alt. 3 mm., lat. 1 mm., but this may well have been an exaggeration and it is quite possible that they may have included typical specimens of *C. tridentatum* in their new species. Nevertheless it would seem better to restrict the name to the specially elongated variety. We have seen specimens of this striking variety from Brampton Ash, Northamptonshire, and from Purfleet, Essex, as well as from France, Switzerland, Austria, Yugoslavia and Italy. It seems always to be associated with the normal form of *C. tridentatum,* into which it grades imperceptibly and of which it is evidently only an extreme variety. Like the variety *inflata* of *C. minimum,* it is clearly not a different geographical or ecological race, and therefore should not be treated as a distinct subspecies.

The folds and denticle within the aperture of the shell vary somewhat in their development, as Boycott pointed out in 1901, the projecting end of the columellar fold and the denticle inside the outer lip being occasionally little developed, or even absent. Forbes and Hanley (1852) considered that the specimens with the teeth more or less obsolete formed a distinct variety, but usually these shells are merely not quite fully grown. We have seen two or three isolated specimens, mainly of *C. tridentatum,* from British and Swiss localities, in which the columellar fold, if present, did not extend into the aperture although the shells appeared to be fully grown, but it seems more likely that these should be regarded as abnormal or imperfectly developed individuals than that they should be considered to be varietally distinct.

The variation in size (as distinct from shape), which Boycott (1901) has also briefly considered, is no greater than that of most snails and is certainly not of varietal importance. And it is doubtful whether the variation in sculpture found in both species is of much systematic importance either, being probably mainly due to differences in the environment.

Specific Nomenclature.—The names *C. minimum* Müll. and *C. tridentatum* (Risso) are not specially appropriate to our two species, which are of about equal size and have the same number of teeth in their aperture; but for many years nearly every writer who has separated the two forms has given—we think correctly—the former name to the short species that normally frequents marshes, and the latter to the longer one more often found in woods. One or two authorities, however, have expressed doubts as to whether this usage is really correct, or whether perhaps it may have been the longer species that Müller originally named *C. minimum*, and one of the other species found in the Mediterranean Region that Risso originally named *Saraphia tridentata.* If these doubts were well founded the changes of nomenclature that they would require would produce great confusion. It therefore seems desirable to explain why there seems to be no necessity to make such changes.

Both species are abundant in Denmark, but it is extremely unlikely that Müller would have separated these two minute forms in 1774, more than 50 years before anybody else seems to have done so, and more than 150 years before their specific distinction became at all widely recognized, and it seems practically certain that his *Carychium minimum* was originally a compound of the two species. That he included the broader marsh-frequenting form in his species is indicated by his stating that it was to be found "*in asseribus humidis*" and that the shell was diaphanous, as well as by the fact that this form seems to be much the commoner one in the neighbourhood of Frederiksdal where Müller said his *C. minimum* occurred. Indeed the specimens from there are shorter than the average, as is shown by the statistics of Thorson and Tuxen (1930, p. 296), and the shell kindly given to us by Dr. Schlesch and figured on pl. 9, fig. 1, closely approaches the variety *inflata*, although others from this same place are not quite so short (see Mandahl-Barth (1951), p. 84, figs. 2, 7–10). But Dr. Mandahl-Barth has also sent to us specimens of the narrow species from Frederiksdal, and that Müller included this form in his *C. minimum* as well as the other is shown by his stating that his species was also found among decaying beech leaves, and by the fact that Müller's original drawings, reproduced by Thorson and Tuxen (1930, p. 299, fig. 3) are in most respects nearer this narrow species than the other, although they are too poor for this evidence to carry much weight. Moreover there are in the Linnean collection in London two good specimens of the narrower woodland form which are probably, although not quite certainly, those that Müller himself gave to Linné as examples of his species (see Kennard and Woodward, 1920). But even if it were certain that these were the original two specimens that Müller sent to Linné, this would not imply that they were the true types or syntypes of Müller's species. No such type specimens of *C. minimum* are known to exist. Now when an author thus gives a single name to a mixture of two species which he fails to differentiate, then, in the absence of any authentic type specimen, the first subsequent authors who separate them may restrict the original author's name to either of the forms he included in it and give a new name to the other, and their selection is not later to be reversed. When Risso first gave another name to the narrower species in 1826, he did not explicitly restrict Müller's name to the shorter species, for he never mentioned it. But Anton (1839) and Küster (1841), A. and J. B. Villa (1841), Bourguignat (1857) and Clessin (1884 and 1889), all definitely restricted the name *C. minimum* Müll. to the broader and shorter species and gave other names to the narrower woodland form. Indeed, the only early author we know of who apparently did the contrary was Hartmann (1844), but he expressed his view with no little ambiguity, as we have already explained. All later authors up to the present day, who have regarded the two forms as distinct species, seem to have continued to employ Müller's name for the broad species mainly found in marshes, and to call the narrow species more often found in woods *C. tridentatum* (Risso), and there would thus seem to be no justification for now transferring the name *C. minimum* to the latter species, a course that would clearly cause great confusion.

Risso's original description of his *Saraphia tridentata* (1826) leaves much to be desired. It is accompanied by no illustrations and, according to Professor Fischer-Piette, no examples of this species can be found among Risso's type specimens in Paris (see Schlesch (1947)). But, as we have already mentioned, Bourguignat (1857) thought that this species of Risso could be nothing else than that which was named *C. nanum* by Anton (1839) and Küster (1841), and *elongatum* by A. and J. B. Villa (1841), that is to say the widely distributed narrow woodland species which we are accustomed to call *C. tridentatum*, and the original description agrees better with worn specimens of this species than do the descriptions of Risso's other four supposed species of *Saraphia*. And although one or two other long and narrow species of *Carychium* seem to occur in other parts of the Mediterranean Region, from France and northern Italy we have only seen our common woodland species, and this we have from the Alpes Maritimes, the very district in which Risso found his species. Plate 9, fig. 8 shows how very similar are the specimens found in that locality to those found in Great Britain and Ireland and, we may add, in most other countries in Europe. Accordingly there would seem to be no good reason for using one of the later names that have been given to this species, instead of continuing to call it *C. tridentatum* (Risso).

Acknowledgments.—We are deeply indebted to many collectors for the privilege of allowing us to examine several thousand specimens of *Carychium* from a very large number of different localities, and we should like especially to express our gratitude to the following among them: C. O. van Regteren Altena, Leiden, Holland; John Armitage, Buxton, Derbyshire; A. G. Brighton, Cambridge; A. E. Ellis, Epsom College, Surrey; E. Fischer-Piette, Paris; L. Forcart, Basle, Switzerland; H. W. Harry, Philadelphia; B. Hubendick, Stockholm; D. K. Kevan, Edinburgh; J. G. J. Kuiper, The Hague; G. Mandahl-Barth, Charlottenlund, Denmark; A. D. J. Meeuse, The Hague; R. V. Melville, Geological Museum, London; G. Mermod, Geneva; John Pantin, Cambridge; the late R. A. Phillips, Cork; H. E. Quick, Reading; F. Saxer, St. Gallen. Switzerland; H. Schlesch, Copenhagen; the late W. Thurgood, Leeds; J. R. le B. Tomlin, St. Leonards; and A. Ortiz de Zárata, Nájara, Spain.

REFERENCES.

(Restricted to literature concerning the recent forms of *Carychium* that occur in the British Isles.)

ADAMS, L. E., 1884. *Collector's Manual of British Land and Freshwater Shells*, pp. 95–6, pl. VIII, fig. 9.
—— 1895. *Ibid.*, 2nd edition, p. 117, pl. v, fig. 9.
—— 1900. *J. Conchol.* **9**, pp. 301–2, fig. 5.
ANTON, H. E., 1839. *Verzeichnits der Conchylien*, p. 48.

BALDWIN, J. W., 1909. *J. Conchol.* **12**, p. 325.

BOURGUIGNAT, M. J. R., 1857. *Rev. & Mag. Zool.*, sér. 2, **9**, pp. 209–232 (and *Aménités Malacologiques* **2**, pp. 39–62, with plates).

BOYCOTT, A. E., 1901. *Science Gossip* **8**, pp. 223–4.

CLESSIN, S., 1884. *Deutsche Excursions-Mollusken-Fauna*, 2nd edition, pp. 353–4, fig. 208.

—— 1889. *Molluskenfauna Oesterreich-Ungarns und der Schweiz*, pp. 502–3, fig. 340.

COLBEAU, J., 1865. *Ann. Soc. Malac. Belg.* **1**, pp. 34, 105.

EHRMANN, P., 1933. *Die Tierwelt Mitteleuropas* **2** (1), Mollusken, p. 151.

ELLIS, A. E., 1926. *British Snails*, pp. 97–8, fig. 2.

—— 1941. *J. Conchol.* **21**, pp. 236, 240, 241.

FAVRE, J., 1927. *Mém. Soc. Phys. & Hist. nat. Genève* **40**, pp. 235–6.

FOGERTY, H., 1910. *J. Conchol.* **13**, p. 71.

FORBES, E., & HANLEY, S. C. T., 1852. *History of British Mollusca* **1**, pl. JJJ ; **4**, pp. 198–9 ; pl. CXXV, fig. 6.

GERMAIN, L., 1913. *Mollusques de la France* **2**, pp. 265–6.

—— 1931. *Faune de France* **22**, Mollusques terrestres et fluviatiles (2), pp. 558–9, figs. 591–4.

GEYER, D., 1927. *Unsere Land- und Süsswasser-Mollusken*, 3rd edition, pp. 131–2, pl. VI, fig. 22, pl. VIII, figs. 16–19, 27.

HARTMANN, J. D. W., 1844. *Erd- und Süsswasser-Gasteropoden der Schweiz*, p. 48.

JEFFREYS, J. G., 1862. *British Conchology* **1**, pp. 300–2, pl. VIII, figs. 1–3.

—— 1869. *Ibid.* **5**, p. 162, pl. XVIII, fig. 4.

KENNARD, A. S., 1941. *J. Conchol.* **21**, p. 267.

—— & WOODWARD, B. B., 1920. *J. Linn. Soc.* (Zool.) **34**, p. 204.

—— —— 1926. *Synonymy of the British non-marine Mollusca*, pp. 35–7.

KÜSTER, C. H., 1841. *Systematisches Conchylien-Cabinet*, part 16 (Auriculacea), pp. 4, 5, pl. 1, figs. 8–10.

LEHMANN, R., 1873. *Die lebenden Schnecken und Muscheln der Umgegend Stettins und in Pommern*, pp. 176–8, pl. XV, fig. 63.

LOCARD, A., 1894. *Les Coquilles terrestres de France*, p. 336, figs. 480–1.

MANDAHL-BARTH, G., 1949. *Danmarks Fauna* **54**. Bløddyr 3, Ferskvandsbløddyr, pp. 222–3, 240, fig. 6.

—— 1951. *Flora og Fauna* **56**, pp. 81–5, figs. 1, 2.

MELL, C., 1937. *Verhandl. Zool. Bot. Gesells. Wien*, **86–7**, pp. 249–253.

MERMOD, G., 1930. *Cat. Invertébrés de la Suisse* **18**, Gastéropodes, pp. 441–4.

MOQUIN-TANDON, A., 1856. *Histoire naturelle des Mollusques terrestres et fluviatiles de France* **2**, pp. 413–15, pl. XXIX, figs. 15–26.

MÖRCH, O. A. L., 1864. *Vidensk. Meddel. Naturhist. Foren. Kjöbenhavn*, 1863, p. 297.

MÜLLER, O. F., 1774. *Vermium terrestrium et fluviatilium Historia* **2**, p. 125.

ODHNER, N. H., 1925. *Arkiv. f. Zoologi* **17A**, No. 6, p. 10, pl. 1, fig. 3 ; pl. 2, fig. 16.

QUICK, H. E., 1945. *J. Conchol.* **22**, pp. 6, 8.

REEVE, L., 1863. *Land and Freshwater Mollusks . . . British Isles*, pp. 126–7, figs.

RISSO, A., 1826. *Histoire naturelle . . . Europe méridionale* **4**, pp. 83–4.

SCHLESCH, H., 1947. *Basteria* **11**, pp. 111–12.

STEENBERG, C. M., 1911. *Danmarks Fauna* **10**, Bløddyr 1, Landsnegle, pp. 201–2, figs. 169–170.

STELFOX, A. W., 1911. *Proc. Roy. Irish Acad.* **29B**, pp. 106–7.

THIELE, J., 1931. *Handbuch der Systematischen Weichtierkunde* **2**, p. 465, fig. 556.

THORSON, G. & TUXEN, S. L., 1930. *Vidensk. Meddel. Dansk. Naturhist. Foren.* **88**, pp. 293–300.

VILLA, A. & J. B., 1941. *Dispositio systematica Conchyliarum terrestrium et fluviatilium*, pp. 30, 59.

ZIMMERMANN, F., 1925. *Zeitschrift f. Induktive Abstam. u. Vererbungs* **37**, pp. 291–342, pl. IV.

EXPLANATION OF PLATES 9 AND 10.

PLATE 9.

FIG. 1.—*Carychium minimum* Müller: a rather short and broad specimen from the shore of Furesö, Frederiksdal (the type district), N.E. Zealand, Denmark (H. Schlesch, September 1933).

FIG. 2.—*Carychium minimum* Müller: a narrow specimen from Hauxton Mill, Cambridgeshire (H. Watson, May 1919).

FIG. 3.—*Carychium minimum* Müller var. *inflata* (Hartmann), found in the same locality as the last, with many intermediate specimens (H. Watson, May 1919).

FIG. 4.—*Carychium minimum* Müller: a specimen of normal proportions from Mountmellick, Queen's County, Ireland (D. K. Kevan, November 1930).

FIG. 5.—*Carychium tridentatum* (Risso): a specimen of normal proportions found in the same locality as the last, the other accompanying specimens showing a similar contrast between them (D. K. Kevan, November 1930).

FIG. 6.—*Carychium tridentatum* (Risso): a relatively short and broad specimen from Brampton Ash, Northamptonshire (A. E. Ellis, September 1923).

FIG. 7.—*Carychium tridentatum* (Risso) var. *elongata* Villa, found in the same locality as the last, with many intermediate specimens (A. E. Ellis, September 1923).

FIG. 8.—*Carychium tridentatum* (Risso): a typical specimen from Grasse, Alpes Maritimes (the type district), S.E. France (H. Watson, February 1904).

FIG. 9.—*Carychium tridentatum* (Risso): a normal specimen from Totternhoe, Bedfordshire (B. Verdcourt, May 1947).

All figures × 25.

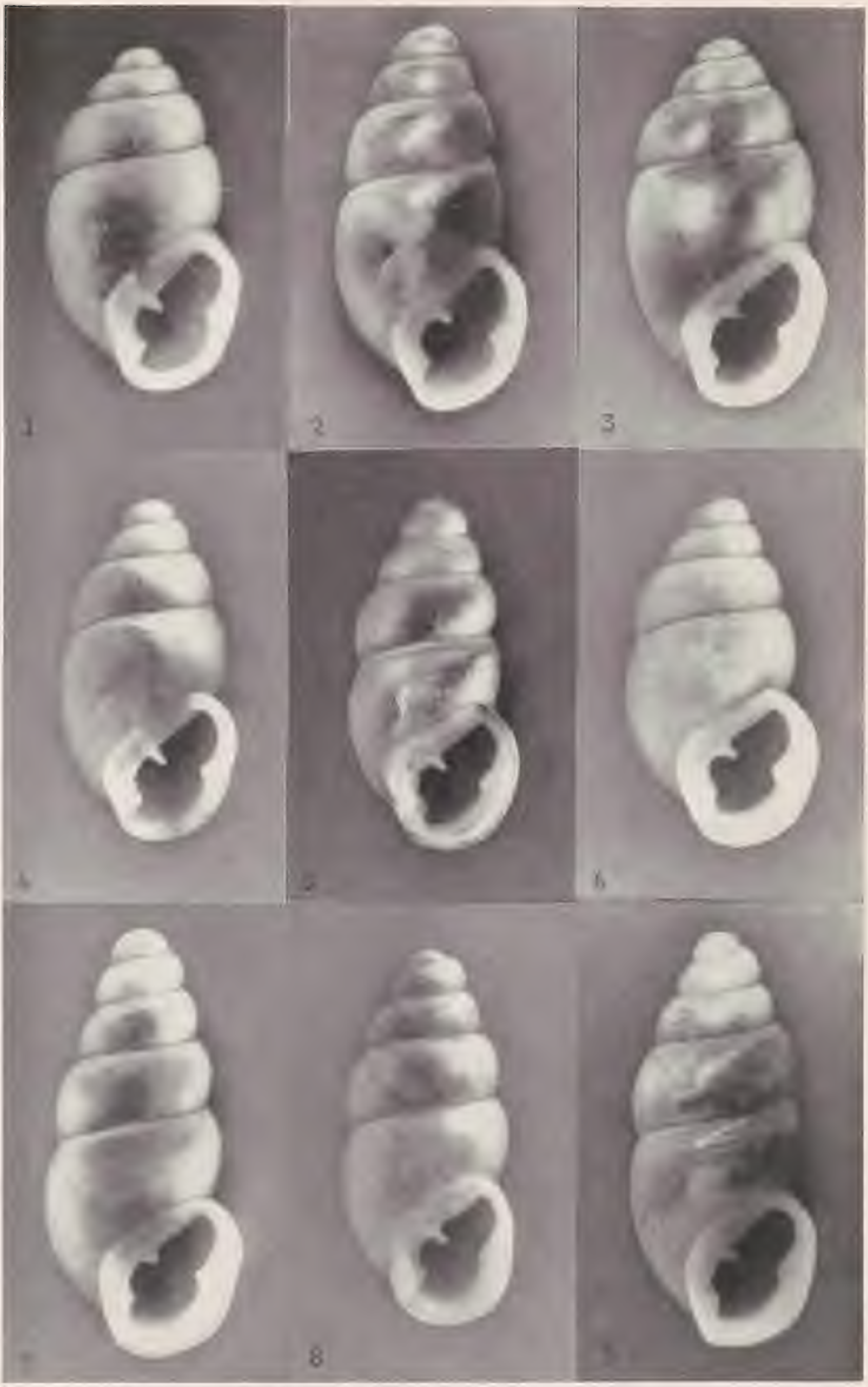
PLATE 10.

FIG. 1.—*Carychium minimum* Müller: representative teeth from the radula, × 2,800. Surlingham, Norfolk (A. E. Ellis).

FIG. 2.—*Carychium tridentatum* (Risso): representative teeth from the radula, × 2,800. Totternhoe, Bedfordshire (B. Verdcourt).

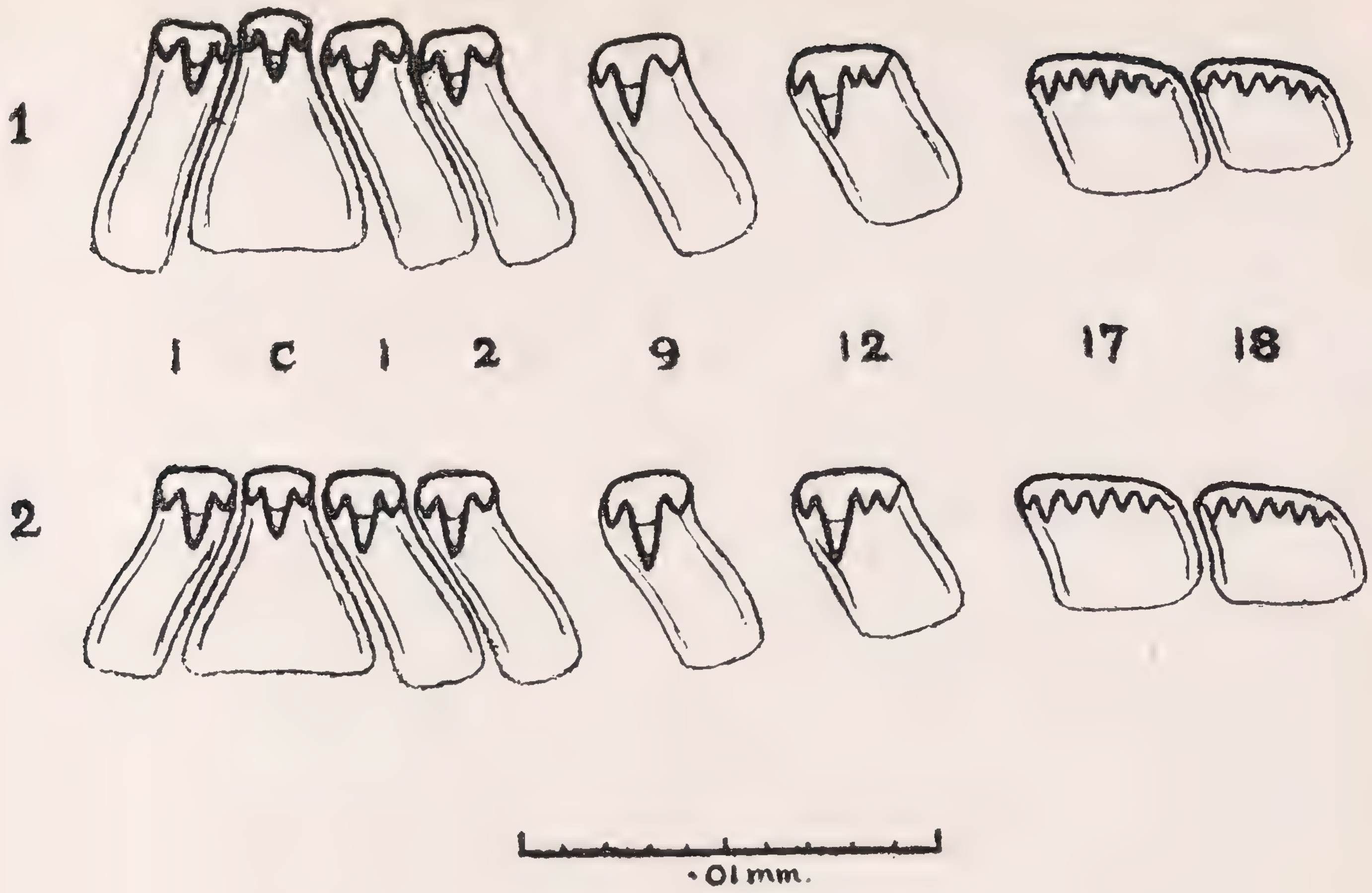
FIG. 3.—*Carychium minimum* Müller: shell opened to show internal folds, × 35. Coe Fen, Cambridge (H. Watson).

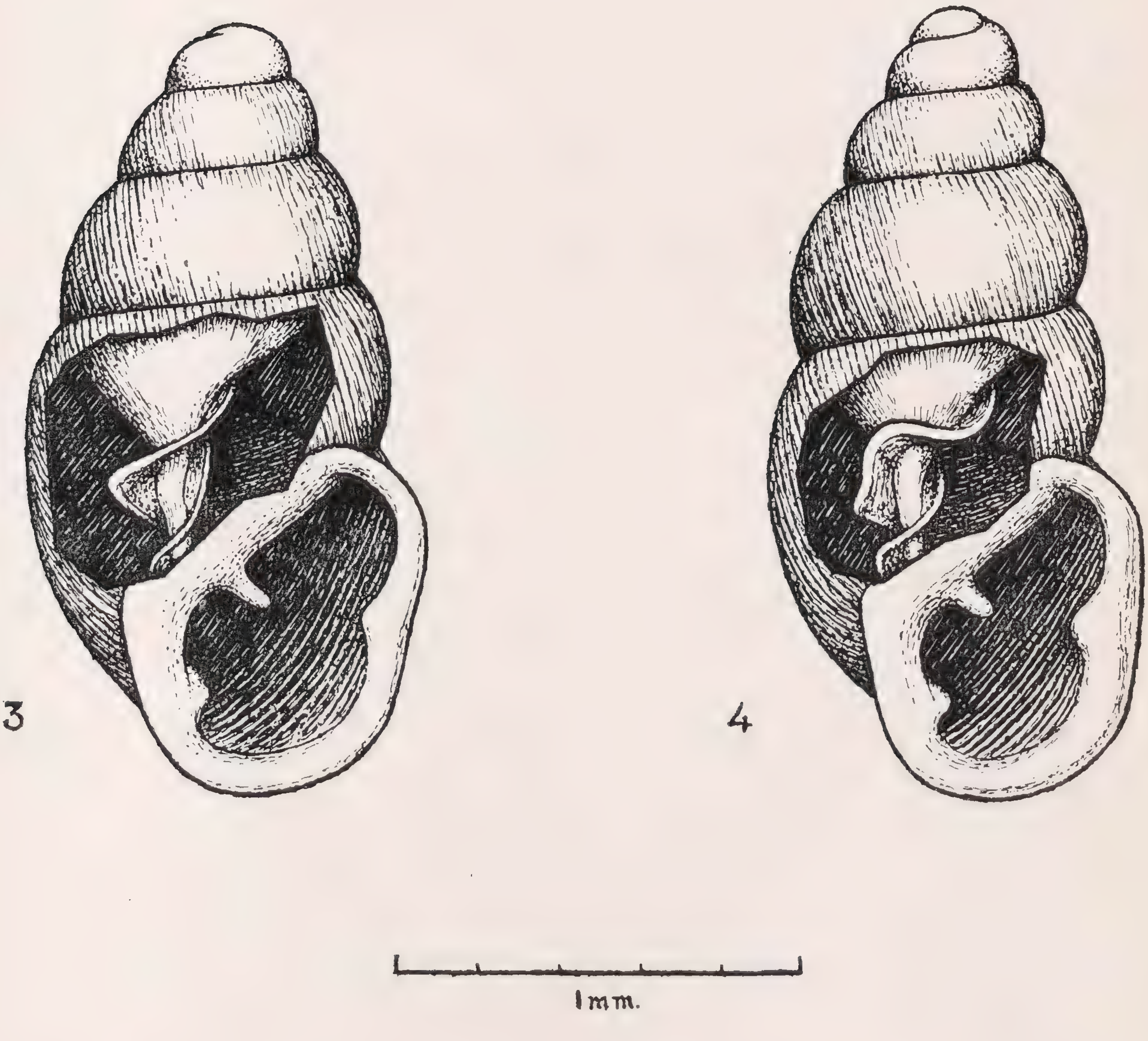
FIG. 4.—*Carychium tridentatum* (Risso): shell opened to show internal folds, × 35. Coe Fen, Cambridge (H. Watson).



Carychium minimum (figs. 1–4) and *C. tridentatum* (figs. 5–9).

[*Facing page* 324





Carychium minimum (figs. 1 and 3) and *C. tridentatum* (figs. 2 and 4).

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1951.

Income and Expenditure Account.

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
Paid in 1950	11	3	0			
For 1951	66	10	0			
Arrears	17	10	0	95	3	0
,, Sales				158	2	7
,, Transfer from Life Membership Fund	22	11	7			
,, Research Fund	11	16	0	34	7	7
,, Grants from Research Fund .				100	0	0
,, Royal Society Grant				50	0	0
,, Donations				8	0	0
				£445	13	2

Cr.

	£	s.	d.	£	s.	d.
By Publication and Distribution—						
Journal, vol. 23, part 5 .	71	11	2			
Reprints, vol. 23, part 5 .	10	6	6			
Journal, vol. 23, parts 6, 7 . being Census Number .	252	13	5	334	11	1
,, Legal Charges				3	3	0
,, Printing and Stationery . .				17	2	2
,, Fire Insurance				1	0	0
,, Zoological Record					8	0
,, Zoological Society				2	0	0
,, Lancashire and Cheshire Faunal Committee				1	0	0
,, Officers' Expenses				19	3	8
Balance, being excess of Income over Expenditure				67	5	3
				£445	13	2

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1951 . .	489	14	0
,, Dividends and Interest	22	11	7
	£512	5	7

	£	s.	d.
By Transfer to Income and Expenditure Account	22	11	7
,, Amount of Fund, 31 December 1951 . .	489	14	0
	£512	5	7

Research Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1951	256	16	0	By Transfer to Income and Expenditure Account	22	6	0
,, Dividends and Interest	11	16	0	,, Grant for publication of Census (to Income and Exp. a/c)	100	0	0
				,, Amount of Fund, 31 December 1951	156	16	0
	£268	12	0		£268	12	0

BALANCE SHEET.

Liabilities.

	£	s.	d.	£	s.	d.
Annual Subscriptions in advance				8	13	0
Life Membership Fund				489	14	0
Research Fund				156	16	0
Transfer from Research Fund				100	0	0
Balance from Income and Expenditure Account—						
As on 1 January 1951	299	15	7			
For 1951	67	5	3	367	0	10
				£1,122	3	10

Assets.

	£	s.	d.	£	s.	d.
4% Funding Loan (cost)	350	0	0			
2½% Defence Bonds (cost)	200	0	0			
3½% War Loan (cost)	40	0	0	590	0	0
Cash at Bankers—						
National Provincial Bank	122	17	4			
Post Office Savings Bank	401	6	6			
Cash in hand	8	0	0	532	3	10
				£1,122	3	10

Note.—Assets in addition to those set out in the above Balance Sheet are (*a*) Library, (*b*) Cabinets and Collections, (*c*) Stock of unsold Publications, (*d*) Annual Subscriptions in arrears.

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THE

JOURNAL OF CONCHOLOGY

VOL. 23. 22 MAY, 1953. NO. 10

TRAILL'S LIST OF ORKNEY MOLLUSCA, WITH SPECIAL REFERENCE TO *PINNA FRAGILIS*.

By ROBERT RENDALL.

IN a general paper entitled " Orkney Islands ", contributed by Thomas Stewart Traill, M.D., F.R.S., to Brewster's *Edinburgh Encyclopaedia* (1830), there is one section devoted to Natural History. This contains a catalogue of marine animals listed under the headings Pisces, Crustacea, Vermes and Zoophyta. Under *Vermes* are listed 58 species of Mollusca. This adds 35 species to those in Wallace's list of 1700, which enumerated 52. Eighteen species given in Wallace's list, however, do not appear in that of Traill. The list is a compilation. No authorities are given, though mention in the Bibliography of Wallace's *Description*, Low's *Tour* and MS. notes and drawings, Neill's *Tour* and " Various MS. Notes " show that for his general material he was largely indebted to these earlier naturalists. In an undated letter to Mr. Paton of Edinburgh, the Rev. George Low, shortly before his death in 1795, complains of extensive pirating from his unpublished MS., citing among other instances this article in the *Edinburgh Encyclopaedia*. It is only fair to add, however, that due acknowledgment is made by Traill, both in the Bibliography and in the general text, of his debt to Low.

I have made a careful scrutiny of available literary references to Low's wide range of interests, which included mammals, birds, fishes, insects and plants, but cannot discover any particular reference to shells save a chance notice of pearl ' muscles ' and ' oysters '. His MS. " Microscopical Observations ", " full of beautiful drawings by that ingenious author " (which include two crustaceans, *Monoculus quadricornis* and *M. conchaceus*, and another " which is probably non-descript "), appear to be confined to non-molluscan forms. Also Traill notes that " Mr. Low's industry has left little to be added to the classes mammalia, aves and pisces ; but no author has given us any account of the lower animals which inhabit the Orkney islands ".

Patrick Neill's *Tour* (1806) contains more evident interest in seashore life, including shells, though he mentions only a few specific names. Neill was secretary to the Natural History Society of Edinburgh. Traill consulted his *Tour*, and observed the reference to *Arca glycymeris*, which Neill comments on as being " of uncommon size, twice the size of Pennant's figure of the shell ". Neill also refers to *Venus erycina* (*V. verrucosa*), *Venus paphia* (*V. fasciata*), *Trochus ziziphinus*, *T. umbilicatus* (almost certainly *Gibbula cineraria*), *Cypraea pediculus* (*Trivia arctica*) and *Ostrea maxima*, and does so with a certain enthusiasm. I am therefore of the opinion that, in addition to Wallace, who compiled the primary list of Orkney Mollusca, the name of Neill must be added as supplying "such materials as are within our reach", though this must remain conjectural. Traill himself does not seem to have relied extensively on his own knowledge. The list must therefore be attributed to Traill's authority, leaving its sources undetermined.

The sub-title MOLLUSCA is reserved for *Limax*, *Doris*, and (?) *Aphrodita*: that of TESTACEA heads the bivalves and gastropods. In the absence of specimens it is now impossible to check identification, but one or two specific names are open to suspicion, judging from material collected by the late Mr. R. Winckworth and by myself. On the whole, however, the catalogue contains only well-defined common species, abundant locally (with one exception, mentioned below), and roughly marks what little advance in local observation there had been in the century since Wallace.

The inclusion of *Pinna ingens* (*Pinna fragilis* Pennant) is of particular interest. The record seems authentic, since the added words "dredged from the depth of thirty to forty fathoms" point to deliberate collection. No other genus could with any degree of probability have been mistaken for *Pinna*. Since this record no other specimen has been procured in Orkney, so far as I can ascertain, until this year, when a fine example (shell only) was taken on a fisherman's line at the Bring Deeps in Scapa Flow, between the islands of Cava and Graemsay. Charts give the depth here as reaching 29 fathoms, an interesting near correspondence with Traill's record. During the 1914–18 war Winckworth did considerable dredging round Graemsay, in 7 to 12 fathoms, and in Hoy Sound, probably in 20 to 40 fathoms, but did not procure this species. In Forbes and Hanley (2, 258) it is reported as having been found in the Hebrides (Montagu) and in Shetland, in deep water (Forbes). *P. fragilis*, however, is scarce in the north.

Dr. A. C. Stephen has drawn my attention to a note in *Scottish Naturalist*, 1921, 162, under "James Ritchie", on "a fine example of *Pinna fragilis* brought up on a haddock line from a depth of 70 fathoms east of Out Skerries Lighthouse, Shetland, in February 1921, as "being worth recording on account of the size attained in an area generally regarded as being on the border of the northern range of this mollusc". It measured 11½ inches in length, notwithstanding that the original lip had been broken away: its greatest breadth was just over 6 inches. The specimen, now in the Royal Scottish Museum, was forwarded by Mr. Henry Jamieson. The only other Scottish record is that of James Simpson, kindly sent by Mrs. N. F. McMillan. It is found in *Trans. Aberdeen Working Men's Nat. Hist. and Sci. Soc.*, no. 2 (1904), 67: *Pinna rudis* "rather rare. I have only seen about a dozen specimens".

The Scapa *Pinna* was sent by Mr. Mackay, Schoolhouse, South Fara, to ex-Provost G. M. Marwick, Stromness, a keen Orkney naturalist, who reported the find to the local press and placed the shell in the Stromness Museum, where it is now exhibited. The specimen measures 11½ inches long and 5½ inches broad at its wide end; it was more or less covered with marine growths, but retained its brown colour "with rings radiating from the pointed end".

In the lists that follow I have correlated Traill's nomenclature with that of Winckworth (1932), as emended in 1951, but have retained the original spelling for all Traill's forms.

Mollusca

Limax ater	*Arion ater* (L.).
L. cinereus	*Limax maximus* L.
L. agrestis	*Agriolimax reticulatus* (Müller).
Doris pappillosa ?	*Aeolidia papillosa* (L.).
Sepia loligo	*Sepia officinalis* L.
S. media	*Alloteuthis media* (L.).

TESTACEA

Mya truncata	*Mya truncata* L.
M. arenaria	*Mya arenaria* L.
Solen vagina	*Solen marginatus* Montagu.
S. siliqua	*Ensis siliqua* (L.).
S. ensis	*Ensis ensis* (L.).
Tellina ferroensis	*Gari fervensis* (Gmelin).
T. crassa	*Tellina crassa* Pennant.
T. vitrea	*Tellina tenuis* da Costa (?).
T. compressa	?
Cardium edule	*Cardium edule* L.
C. aculeatum	*Cardium aculeatum* L.
C. echinatum	*Cardium echinatum* L.
Mactra solida	*Spisula solida* (L.).
M. stultorum	*Mactra corallina* Montagu.
Arca, Glycymeris, Neill [*sic*]	*Glycymeris glycymeris* (L.).
Venus islandica	*Cyprina islandica* (L.).
V. verucosa	*Venus verrucosa* L.
V. rugosa vel *striatula*	*Venus striatula* (da Costa).
Pecten maximus	*Pecten maximus* (L.).
P. opercularis	*Chlamys opercularis* (L.).
P. obsoletus	*Chlamys tigerina* (Müller).
Ostrea sinuosa (found in Stroma, *Wallace*)	*Chlamys distorta* (da Costa).
O. edulis	*Ostrea edulis* L.
Mytilus edulis	*Mytilus edulis* L.
M. modiolus	*Modiolus modiolus* (L.).
M. pellucidus	*M. edulis var. pellucidus ?* (F. & H. 2, 178).
M. rugosus	*Hiatella striata* Fleuriau.
Pinna ingens	*Pinna fragilis* Pennant.
Cypraea pediculus vel *arctica*	*Trivia arctica* (Montagu).
Bulla ?	*Akera ?*
Buccinum undatum	*Buccinum undatum* L.
B. lapillus	*Nucella lapillus* (L.).
B. minutum	*Nassarius incrassatus* (Ström).
Murex erinaceus	*Ocenebra erinacea* (L.).
M. antiquus	*Neptunea antiqua* (L.).
M. turricula ?	*Lora turricula* (Montagu).
M. costatus ?	*Mangelia coarctata* (Forbes).
M. rufus	*Lora rufa* (Montagu).
Trochus zizyphinus	*Calliostoma zizyphinum* (Lamarck).
T. umbilicatus	*Gibbula umbilicalis* (da Costa).
Turbo littoreus	*Littorina littorea* (L.).
T. clathrus	*Clathrus clathrus* (L.).
T. terebra	*Turritella communis* Risso.
T. ulvae ?	*Hydrobia ulvae* (Pennant).
Helix albella vel *ericitorum*	*Helicella itala* (L.).

H. lapicida	*Helicigona lapicida* (L.) [highly improbable].
Nerita glaucina	*Natica catena* (da Costa).
N. littoralis	*Littorina littoralis* (L.).
Patella vulgata	*Patella vulgata* L.
P. pellucida	*Patina pellucida* (L.).
P. laevis ?	*Patina laevis* (Pennant). [conspecific with *P. pellucida*).
Teredo navalis	*Teredo norvagicus* Spengler.

REFERENCES.

FORBES, F., & HANLEY, S., 1849. *History of British Mollusca* **2.**

LOW, G., 1879. *A Tour through the Islands of Orkney and Shetland.* Kirkwall.

NEILL, P., 1806. *A Tour Through Some of the Islands of Orkney and Shetland.* Edinburgh.

RENDALL, R., 1948. Wallace's List of Orkney Mollusca. *J. Conchol.* **23,** 17–19.

TRAILL, T. S., 1830. Orkney Islands. Brewster's *Edinburgh Encyclopaedia* **16,** 1.

WALLACE, J., 1700. *An Account of the Islands of Orkney.*

WINCKWORTH, R., 1932. The British Marine Mollusca. *J. Conchol.* **19,** 211–262.

—— 1951. A List of the Marine Mollusca of the British Isles : Additions and Corrections. *J. Conchol.* **23,** 131–134.

ON *PARASTROPHIA ASTURIANA* DE FOLIN

By B. S. KISCH.

[PLATE 11.]

Parastrophia asturiana is one of the numerous species named and described by the Marquis de Folin in *Les Fonds de la Mer*, a very rare work which has formed the subject of several articles in the *Proceedings of the Malacological Society* (Iredale, 1921, Winckworth 1941 and 1945, Rehder 1946).

This curious and little known shell occurs in patches of black drift which appear from time to time at low tide on the beach at Socoa in the bay of Saint-Jean-de-Luz, Basses Pyrénées, and, more rarely, on the beach at Hendaye. In May and June, 1951, they were particularly numerous at Socoa, over 100 being collected during this period. All the shells were empty : indeed, the animal of *Parastrophia* is still unknown, although the genus was founded over 80 years ago. Many of the shells found at Socoa were fresh and in perfect condition. As they are extremely fragile, it seems likely that their habitat is not far distant. The Laboratoire de Malacologie of the Muséum National d'Histoire Naturelle at Paris contains specimens of *P. asturiana* obtained by de Folin from Gijon on the Asturian coast, from Hendaye and from two miles off the mouth of the river Adour, but apparently all these were also empty shells.

Four specimens from Socoa are figured on plate 11. Figure 1 shows the typical form with its minute spiral nucleus. In figure 2 the characteristic twist is slightly more marked than usual. In figure 3 the spiral nucleus is missing, the apex terminating in a blunt point ; this form is not uncommon, and is mentioned by de Folin (1881, **4,** 20) as resulting from the nucleus being broken off and the shell repaired. A few shells have a hook at the tip instead of a spiral: one of these is shown in figure 4. For these admirable photographs I am greatly indebted to Mr. C. E. B. Dobb, of Birkbeck College.

De Folin gives the measurements of *P. asturiana* as 3 mm. in length and 0·5 mm. in diameter; the largest specimens found at Socoa are 4 mm. in length, with a width of 0·5 mm.

This shell has given rise to misconceptions in the past. Some specimens, dredged at Spezzia, came into the possession of Jeffreys, but he mistook them for the young of *Caecum trachea* (Montagu) (Jeffreys 1867). Monterosato (1875) made the same mistake, although meanwhile de Folin (1869, **1**, 218, pl. 29, fig. 7) had named and described *P. asturiana* from specimens dredged in 18 fathoms off the north coast of Spain. De Folin addressed himself to removing this misapprehension: he pointed out, *inter alia*, that the nucleus of *Caecum* is composed of two or three whorls in the same axis as the tube, whereas the nucleus of *Parastrophia* is composed of one to one and a half whorls and is set obliquely to the axis of the tube. Further, the nucleus of *Parastrophia* is much smaller than that of *Caecum*, while the average length of *Parastrophia* is equal to that of the full grown *Caecum trachea* (de Folin 1877).

Two of the shells from Socoa were sent to the United States National Museum at Washington for comparison with the so-called fry of *C. trachea* in the Jeffreys collection. Dr. Rehder, who was kind enough to compare them, can discover no real difference between the shells which Jeffreys labelled "*Cæcum trachea* Fry" and the specimens from Socoa; the former are, in fact, *P. asturiana*. Dr. Rehder adds that "someone has already noted this on the label of Jeffreys' specimens, possibly Jeffreys himself". This is not improbable, as Jeffreys accompanied de Folin in the exploration of the Bay of Biscay on the French research ship *Travailleur* and collaborated in volumes 3 and 4 of *Les Fonds de la Mer* (see **3**, title-page, and **4**, 140).

The only specimens of *P. asturiana* I was able to trace in the British Museum (Natural History) were two in the Norman collection, wrongly labelled *Spirolidium mediterraneum* O. G. Costa. *S. mediterraneum* has been shown to be the young of *Caecum* (*Brochina*) *glabrum* (Montagu) (Monterosato 1875; Thiele 1929). Both the British Museum and the United States National Museum now possess good series of *P. asturiana* from Socoa.

The generic name *Parastrophia* is also due to de Folin. He founded the genus under the name *Moreletia* (1869, **1**, 120) to accommodate a species from Hongkong (*M. cornucopiae* de Folin, **1**, 122), but changed it shortly afterwards to *Parastrophia* (**1**, 174), the name *Moreletia* being preoccupied by *Moreletia* Gray, 1855. Besides *P. asturiana* and *P. cornucopiae*, three other species of *Parastrophia* have been described: *P. challengeri* de Folin (1881, **4**, 20, pl. 2, fig. 2),[1] *P. folini* Bucquoy, Dautzenberg and Dollfus (1882) and *P. filum* Melvill (1906). The collections in the Laboratoire de Malacologie contain two further species, *P. subtriangulata* de Folin from Cadiz, and *P. subannulata* de Folin from Australia (*sic*). I have not so far been able to trace where they have been described: the descriptions are not to be found at the Laboratoire de Malacologie, nor among the papers of de Folin presented by his descendants to the Musée de la Mer at Biarritz in 1935, together with his collections. They may have been intended to appear in his *Monographie de la Famille des Caecidae*, of which only the first part appears to have been published (31 pages, 1 plate, Bayonne, 1875). A number of original plates intended for subsequent parts of the *Monographie* was found among de Folin's papers presented to the Musée de la Mer. The Winckworth collection in the British Museum (Natural History) contains a single specimen of a *Parastrophia* with a sculpture of very bold, ring-like ribs, labelled *P. challengeri*, Hope Island, Queensland: it is certainly not *P. challengeri* and may prove to be a new species.

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[1] The first three figures on plate 2 appear to have been wrongly numbered, both on the plate and in the text: from the descriptions it seems clear that fig. 1 is *Watsonia elegans*, fig. 2 is *Parastrophia challengeri* and fig. 3 is *Strebloceras subannulatum*.

As stated above, the soft parts of *Parastrophia* are unknown. De Folin (1869, **1**, 120) placed the genus tentatively among the Caecidae, in which he was followed by Bucquoy, Dautzenberg and Dollfus (1882) and Thiele (1929); Fischer (1885) treated it as a subgenus of *Caecum*. Wenz (1939), while placing it with the Caecidae, regarded the position of the genus as open to question—"Systematische Stellung fraglich"—and added "? Pteropoda". If the living animal can be discovered these doubts will be resolved.

REFERENCES.

BUCQUOY, E., DAUTZENBERG, P., and DOLLFUS, G., 1882. *Les Mollusques marins du Rousillon*, **1**, 232.

FISCHER, P., 1885. *Manuel de Conchyliologie*, 697.

DE FOLIN, L., 1867–1887. *Les Fonds de la Mer.*

—— 1877. Note relative au genre Parastrophia. *J. Conchyl.* **17**, 203–207, pl. 5, figs. 1–4.

IREDALE, T., 1921. *Les Fonds de la Mer. Proc. Malac. Soc.* **14**, 202–203.

JEFFREYS, J. G., 1867. *British Conchology*, **4**, 77.

MELVILL, J. C., 1906. New Mollusca from the Persian Gulf. *Proc. Malac. Soc.*, **7**, 80, pl. 8, fig. 27.

MONTEROSATO, T. A. DI, 1875. *Poche Note sulla Conchyologia Mediterranea*, 12.

REHDER, H. A., 1946. Additional notes on the dates of publication of *Les Fonds de la Mer. Proc. Malac. Soc.* **27**, 74–75.

THIELE, J., 1929. *Handbuch der systematischen Weichtierkunde* **1**, 187.

WENZ, W., 1939. *Handbuch der Paläozoologie*: Gastropoda **6**, Teil 3, 681–682.

WINCKWORTH, R., 1941. *Les Fonds de la Mer*: dates of publication. *Proc. Malac. Soc.*, **24**, 149–151.

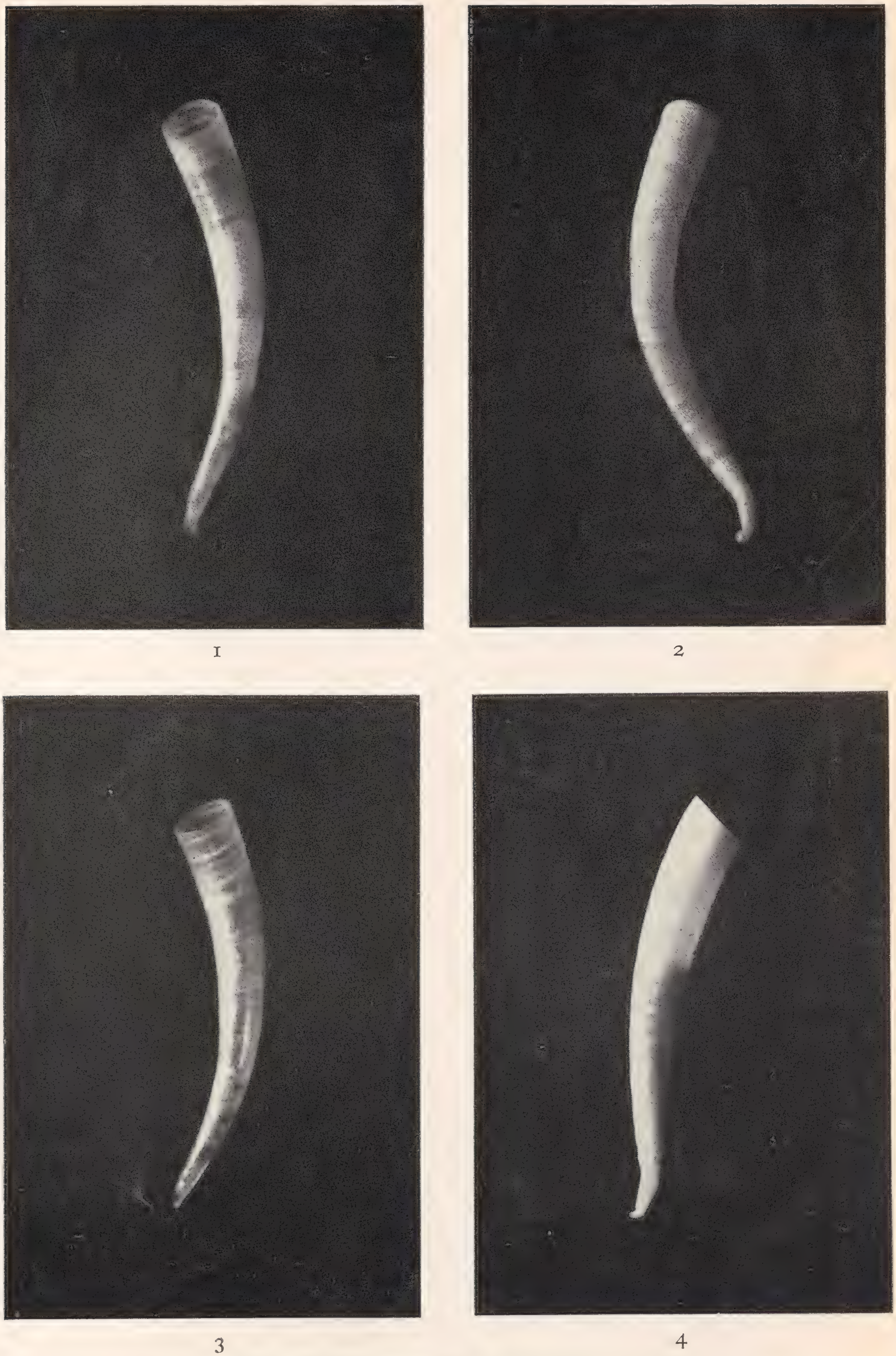
—— 1946. *Les Fonds de la Mer. Proc. Malac. Soc.* **26**, 179.

Note.—The dates in the text of references to *Les Fonds de la Mer* follow Rehder (1946).

EXPLANATION OF PLATE 11.

Parastrophia asturiana de Folin (× 15).

FIG. 1.—Typical form with minute spiral nucleus.
FIG. 2.—Form with characteristic twist more marked than usual.
FIG. 3.—Form with apex terminating in a point instead of a spiral.
FIG. 4.—Form with apex terminating in a hook.



Parastrophia asturiana de Folin (× 15).

VISUAL SELECTION BY TONE OF *CEPAEA NEMORALIS* (L).

By A. J. Cain, M.A., D.Phil., Department of Zoology and Comparative Anatomy, University Museum, Oxford.

(*Read before the Society*, 17 *January* 1953.)

[Plate 12.]

It has been shown (Cain and Sheppard 1950, 52; Sheppard 1951, 52) that in the highly polymorphic snail *Cepaea nemoralis* (L.) the proportions of varieties in each colony are considerably influenced by visual predatory selection. The predator principally investigated was the song thrush (*Turdus ericetorum* Turton), but many other birds probably eat this species. Because of the visual selection, yellow shells are more abundant on greener backgrounds, banded shells on more variegated ones. In such habitats as dense beechwoods, with their very uniform dark carpet of leaves, twigs and cupules, pink, red and brown unbanded shells are the most abundant.

Over 100 colonies have now been investigated, and almost all show this correlation of variation with background very well (Cain and Sheppard, in press). Four colonies are exceptional. These are at Thruxton and Kimpton Down, both west of Andover (Hants), Crowell Hill near Chinnor (Oxon.), and Aston Tirrold near Wallingford (Berks.). Although exceptional, they are not diverse, but on the contrary resemble each other in many important features. All are on downland, or steep slopes infested with rabbits, and all show a much higher proportion of pink and brown shells and a much lower proportion of yellow than would be expected from their backgrounds. The composition of these exceptional colonies is given in Table I. Their backgrounds are as follows:

Thruxton.	Long coarse grass, with a few scattered shrubs, mainly hawthorn.
Kimpton Down.	Short rabbit-grazed turf, with a number of clumps of elders interspersed with hawthorns and brambles concealing a warren half-way up the slope.
Crowell Hill.	Similar to Kimpton Down.
Aston Tirrold.	Coarse grass with a rather high proportion of thistles, scabious, knapweeds and similar herbs, and several scattered bushes.

Rabbits are present in all these localities, abundant at all but Aston Tirrold and probably plentiful there also. They eat large quantities of *Cepaea*, leaving the broken shells lying around, especially on ground sheltered by thorn trees. Tame rabbits will also accept *Cepaea* readily. Like rats, they break in the body whorl some distance from the mouth of the shell, whereas thrushes tend to smash the upper whorls. It appears from Walls' review (1942) that rabbits, like many other mammals, are colour-blind. As they often feed during the day, and are very important predators of *Cepaea* at these localities, it is a reasonable hypothesis that they also may exert visual selection but by tone only, not by colour and tone as thrushes do. To a rabbit a rich pink shell might appear more like green grass than a yellow one.

Three independent estimates of tone were therefore made.

(i) Five shells selected for diversity of colour were photographed on a background of fresh green grass, using a film of nearly constant sensitivity from red to blue-green. (Ilford N30, Technical Information Sheet No. P.40.) The result is shown in Plate 12. The shells used, all from Kimpton Down, were a deep brown, a deep pink with a single black band, a yellow, and two weathered shells that had lost their periostracum. One appeared a pale chalky pink, the other (formerly brown) was a rather pale dull violet. It will be seen that, when the highlights on the periostracum are disregarded, there is no doubt that the tone of the pink shell best matches that of the grass. The brown shell is rather too dark, the yellow too light, and the weathered shells much too light.

(ii) Two red-green colour-blind members of the Department kindly consented to assist. They were asked to look at the same shells and grass as are shown in the photograph, arrange the shells in order of apparent paleness, and say which seemed to match the grass best. In complete independence of each other, both placed all but one of the shells in the same order as is indicated by the photograph, and unhesitatingly chose the pink shell as the best match. The only divergence was over the pale violet shell, which was placed by one as would be expected from the photograph, and by the other, who is only partially colour-blind, after considerable hesitation, between the pink and brown. He remarked that its pigment was dark but obscured by weathering.

(iii) The Villalobos Colour Atlas (Villalobos and Villalobos 1947) was used to obtain an estimate of the tone of the same five shells. In this atlas on each page are the derivatives of a single hue, ranked with intensity increasing towards the left-hand side of the page, and saturation towards the bottom. (In mixing colours the intensity is decreased by dilution with a transparent medium, the saturation is decreased by adding a neutral tint.) The pages are numbered 1 (red) to 38 (purplish red), through the spectrum (pure yellow is 11, pure green 19), and on each page intensity decreases from 0 (very intense) to 20 (extremely pale) and saturation increases from 0 (pure neutral tint) to 12 (pure colour). Any colour-match can therefore be specified by three numbers. A dark tone can be produced both by a high intensity (a high concentration of pigment, for example) and by low saturation.

The same shells were matched against the colour atlas by five persons independently. The results are shown in Table 2, where in each entry the first number represents the hue, the second intensity and the third saturation. In Table 3 are similar figures for deep green lawn grass. Each observer was given a handful of grass blades and asked to match the first three taken at random.

It is obvious that none of the shells matches the grass in hue very well, but the yellow comes nearest to it. In fact, the approximation is rather better when live shells are used, since the presence of the snail's body often gives a greenish tinge to the shell. In intensity and saturation taken together, as both affect the tone, the brown shell comes nearest to the very rich green grass that was used, and the pink next. The dull violet shell has too high an intensity-number and too low a saturation-number —that is, the violet colour was rather weak and very dirty—which accounts for the difficulty in tone-matching it experienced by one of the colour-blind observers.

It seems then that all three methods of estimating tone show that the yellow shell is too light. The two most direct point to the pink as the best match, the other (which does not give a simple indication of tone) to the deep brown, with the pink as next best. This makes it highly probable that rabbits are exerting a visual selection against yellow shells on grassy backgrounds. The other downland colonies available for comparison are at Rough Down and Rockley, both near Marlborough (Wilts.), investigated by Dr. Sheppard (Sheppard 1952), and at Christmas Common, near Watlington (Oxon.). All show a far higher proportion of yellow (between 40 and 50 per cent), and fit in well with the general correlation. At Rockley and Rough Down rabbits are plentiful, but we have found almost no evidence that they are eating these snails. At Christmas Common, however, they were certainly doing so. There is no evidence available about the abundance of rabbits at this locality in the past, nor about the relative intensity of predation by them and by birds. In view of the extraordinary delicacy of the selection exerted by birds (Sheppard 1951, Cain and Sheppard 1952) it seems best to conclude that the situation at Christmas Common, as well as at Rough Down and Rockley, is such that visual selection for colour appears predominant at the present moment, while at the four exceptional colonies selection for tone is more important.

I am grateful to Dr. E. B. Ford, F.R.S., and Dr. P. H. T. Hartley, who have read this paper in MS., to Mr. P. L. Small for arranging and carrying out the photographing, to Messrs. I. C. J. Galbraith, W. Galbraith, M. G. Hardy, J. Hull and M. H. Williamson, who matched colour and tone for me, and to my colleague Dr. P. M. Sheppard for colour-matching, collaboration and advice. This and our other work on *Cepaea* was done in the Department of Professor A. C. Hardy, F.R.S., to whom we are greatly indebted for facilities and encouragement.

REFERENCES.

CAIN, A. J., and SHEPPARD, P. M., 1950. Selection in the polymorphic land snail *Cepaea nemoralis*. *Heredity*, **4**, 275–294.

—— —— 1952. The effects of natural selection on body colour in the land snail *Cepaea nemoralis*. *Heredity*, **6**, 217–231.

SHEPPARD, P. M., 1951. Fluctuations in the selective value of certain phenotypes in the polymorphic land snail *Cepaea nemoralis* (L.). *Heredity*, **5**, 125–134.

—— 1952. Natural selection in two colonies of the polymorphic land snail *Cepaea nemoralis*. *Heredity*, **6**, 233–238.

VILLALOBOS, C., and VILLALOBOS, J., 1947. *Colour Atlas*. El Ateneo, Buenos Aires.

WALLS, G. L., 1942. *The vertebrate and its adaptive radiation*. Cranbrook Press, Bloomfield Hills, Michigan, U.S.A.

TABLE 1.—COMPOSITION OF FOUR ABNORMAL COLONIES OF *Cepaea nemoralis*

Locality	YELLOW				PINK				BROWN					
	00000	00300	12345	Others	00000	00300	12345	Others	00000	00300	12345	Others	Total	% Yellow Shells
Crowell Hill	0	0	24	8	13	0	77	18	0	0	0	0	140	23
Aston Tirrold	6	0	4	5	7	0	7	16	20	0	0	1	66	23
Kimpton Down	0	1	11	1	18	20	13	2	10	9	8	1	94	14
Thruxton	0	0	0	0	2	115	8	2	24	5	0	0	156	0

TABLE 2. RESULTS OF COLOUR-MATCHING SHELLS WITH THE VILLALOBOS ATLAS.

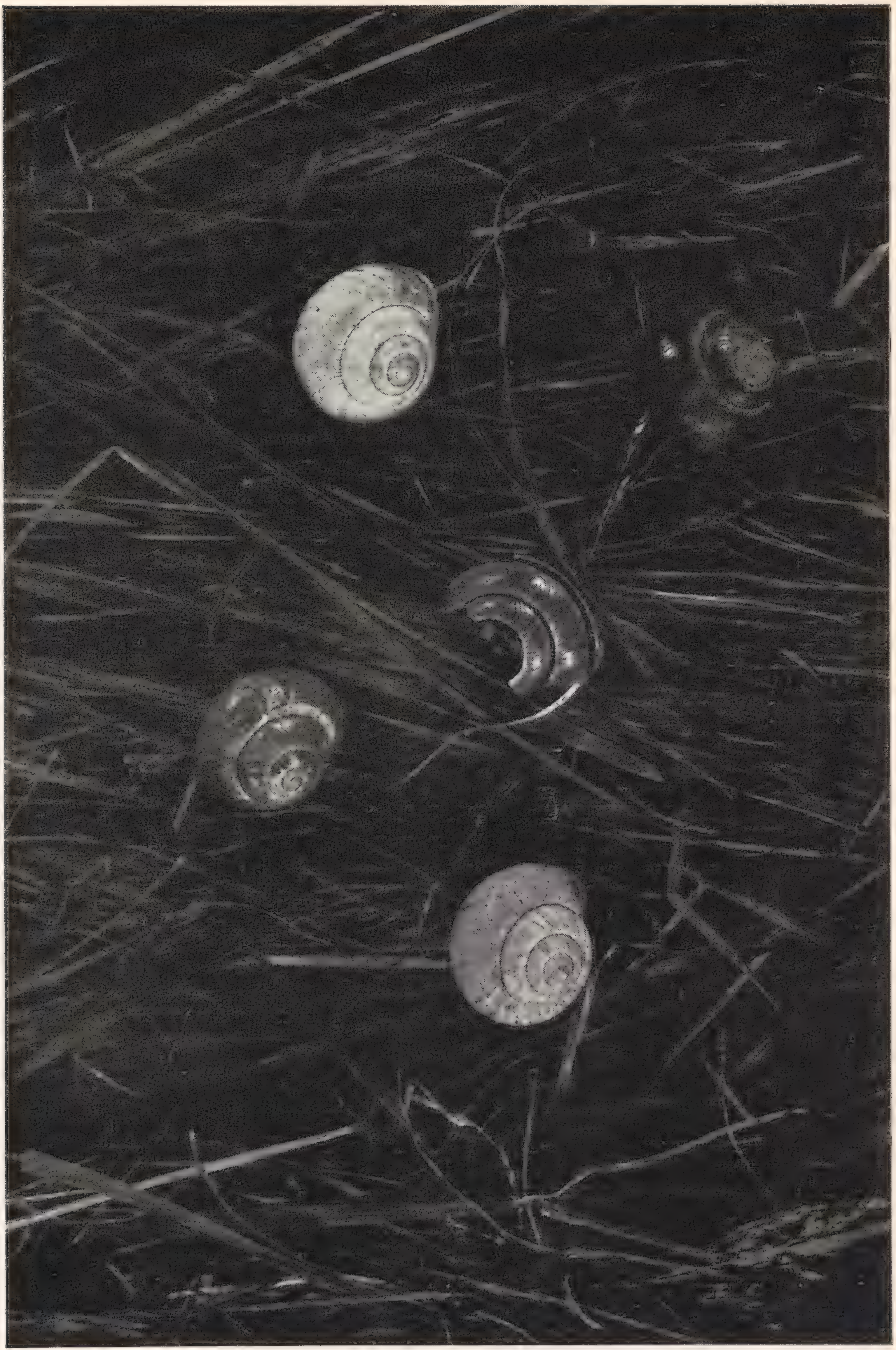
Observer	Pale Pink	Dull violet	Yellow	Pink	Brown
1	2. 16. 5	32. 14. 3	9. 15. 7.	4. 10. 6	5. 3. 6.
2	2. 17. 9	31. 14. 4	9. 16. 8	5. 13. 7	5. 4. 8.
3	3. 17. 9	33. 15. 2	10. 16. 5	5. 12. 7	5. 6. 3.
4	2. 17. 6	35. 17. 6	9. 17. 9	5. 14. 7	5. 6. 7.
5	2. 16. 5	33. 12. 2	11. 15. 7	4. 10. 7	5. 4. 3.

TABLE 3. COLOUR MATCHING OF GRASS.

Observer	First Match	Second	Third
1	16. 5. 4	15. 5. 7	16. 5. 4
2	18. 4. 4	17. 4. 7	17. 5. 7
3	16. 6. 4	15. 7. 5	16. 7. 8

EXPLANATION OF PLATE 12.

Shells of *Cepaea nemoralis* photographed on a background of green grass with a colour-insensitive plate. Top left, weathered pale pink; top right, dark brown. Centre, pink one-banded (00300); centre left, yellow. Bottom, weathered dull violet.



Cepaea nemoralis (L.).

[*Facing p.* 336.

CYPRAEIDAE AT AKABA, JORDAN.

By Major R. J. GRIFFITHS.

(*Read before the Society*, 17 *May* 1952.)

IN the summer of 1950 I was stationed in Akaba, the only port owned by the state of Jordan, and there, with the aid of an underwater swimming mask, I made a collection of Cypraeidae. One of the difficulties of collecting was the small amount of explorable coastline, of which Jordan only possesses about four miles. Entry into Egyptian, Israeli and Saudi Arabian territory, all of which were visible from Akaba, was forbidden. Further disadvantages were the almost complete lack of tide, and the steep shelving of those parts of the coast where rocky outcrops or large stones formed suitable cowry breeding grounds. The danger from sharks did not encourage research in deeper waters.

The following species were found alive in Jordanian waters :

Paulonaria macandrewi (Sowerby)	Schilder (1938), No. 10	very rare
Erosaria nebrites nebrites (Melvill)	,, ,, ,, 29Aa	very rare
Erosaria turdus (Lamarck) (probably subspecies *turdus*)	,, ,, ,, 35Aa	common
Erronea caurica quinquefasciata (Roeding)	,, ,, ,, 74Cb	very rare
Palmadusta ziczac misella (Perry)	,, ,, ,, 89B	very rare
Palmadusta gracilis notata (Gill)	,, ,, ,, 93B	very rare
Mauritia grayana Schilder	,, ,, ,, 149	rare

In addition I was given a dead shell of *Cypraea lynx williamsi* Melvill, alleged to have been found near by.

The presence of *P. ziczac* in Akaba is of particular interest. Schilder does not record its presence in the Red Sea. Since it is present in Akaba, it is probably to be found in the South Erythraean Region, as well as in other parts of the North Erythraean Region.

The list I have given is probably incomplete, even for the small part of the Gulf of Akaba which I was able to investigate. I paid little attention to coral reefs, and confined myself almost entirely to examination of rocks and large stones. Even on these, it was difficult to locate and collect small species at depths of more than five feet.

REFERENCE.

SCHILDER, F. A., and SCHILDER, M., 1938. Prodrome of a Monograph on living Cypraeidae. *Proc. Malac. Soc.*, **23**, 119–231.

GIANT *UNIO PICTORUM* (L.) IN NOTTINGHAMSHIRE.

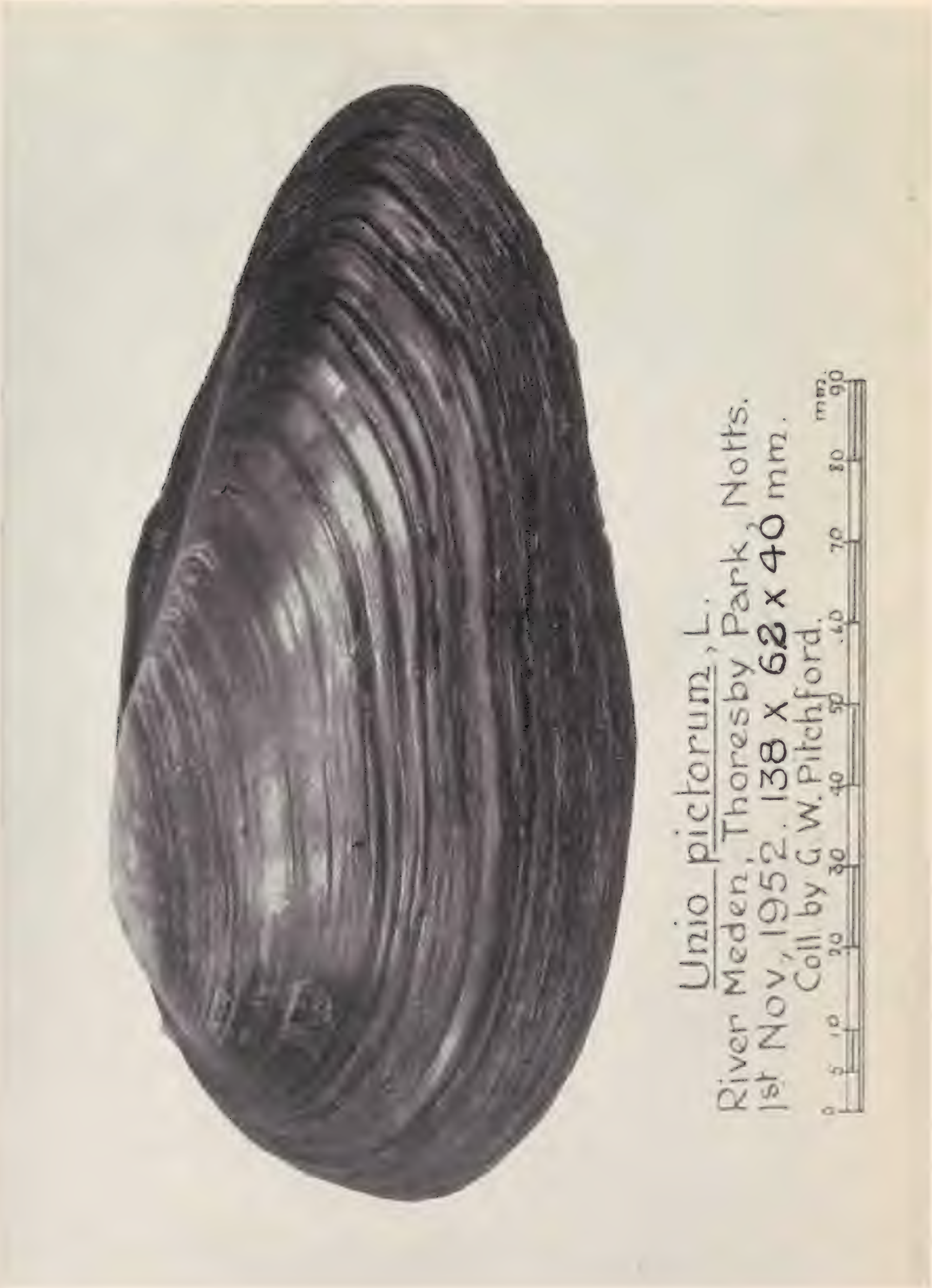
By G. W. Pitchford.

[Plate 13]

Thoresby Park is situated within the Dukeries, in N.W. Nottinghamshire, and was enclosed out of Sherwood Forest in 1683 by the Duke of Kingston. The present mansion was erected in 1864–75. On 1 November 1952 I received permission to investigate Thoresby Lake for Unionidæ. The lake covers approximately 65 acres, and is fed by the River Meden, which rises near Hucknall under Huthwaite, flows in an easterly direction through the magnesian limestone escarpment near Pleasley, and to the adjacent triassic bunter beyond, joining the River Idle near Elkesley. At the tail end of the lake the water passes over a weir to cascade into the river below. A short distance from the weir the stream is divided by an island. Between the end of the island and the second weir, from the left bank I noticed a small *Unio pictorum*, and so made a thorough search of the river-bed, which is thick black mud hereabouts. Ten living *U. pictorum* were landed, which measured from 32 mm. to 128 mm. in length, and a recently dead shell 138 × 62 × 40 mm. The shells are not decorticated. The periostracum of the young shells is pale yellow ; in larger examples it varies from tawny yellow to brown. The nacre varies in the young shells from white to a bright coppery hue, and in larger examples it is sometimes stained with brownish patches, similar to those found in *Anodonta cygnea*. Aquatic weeds were not to be found in the part of the river investigated, except the marginal bur-reed (*Sparganium*). On the undulating sandy river-bed, below the third weir, dead shells of large *U. pictorum* are to be found in abundance. One picked out at random, measuring 131·5 mm. in length, corresponds with that taken by Gain and Musson, from Ossington Lake, Notts. (1884). Good examples of *A. cygnea* and *A. anatina* were also collected. Other Mollusca found were : *Theodoxus fluviatilis* (L.), *Physa fontinalis* (L.), *Ancylus fluviatilis* Müller and *Sphaerium corneum* (L.), some of which were found clustered within a dead shell of *U. pictorum*. Among willow-herb (*Epilobium hirsutum*), on the tracks of the water vole (*Arvicola amphibius*), three separate lots of young *Anodonta* shells were found, the dead shells being in each case approximately two feet from the water's edge. About a third of the posterior end of the shells had been bitten off to open them. It was evident that the vole does occasionally take young *Anodonta* for food. Roach, pike, perch, gudgeon and eels are in the river, and small trout have recently been introduced. The stretch of river investigated lies within the parish of Budby-cum-Perlethorpe.

Dr. Hynes of Liverpool University has very kindly determined the calcium content of a sample of water from the River Meden. He gave the following figures : 153 mg. Ca per litre (i.e. 153 parts Ca per million). This refers only to calcium : the total hardness equivalent would be higher because of magnesium salts also dissolved in the water. Clearly the water is very hard indeed.

My very sincere thanks are due to Mr. John Armitage for so kindly photographing the largest shell, and to Dr. Hynes for his kindness in making hardness determinations of the water from the River Meden.


Unio pictorum, L.
River Meden, Thoresby Park, Notts.
1st Nov., 1952. 138 x 62 x 40 mm.
Coll by G.W. Pitchford.
0 5 10 20 30 40 50 60 70 80 90 mm.

OBITUARY

J. E. COOPER, 1864–1952

JAMES EDDOWES COOPER, well known to many conchologists, passed peacefully away in his sleep on 17 August 1952 at his sister's home at Bedford. Born on 5 August 1864, at St. Helier, Jersey, he was the eldest son of James Cooper, of Sidcup, Kent, and his wife Mary Catherine (née Eddowes), of Shrewsbury. He was educated at Victoria College, Jersey, and, when the family moved to England in 1879, at Queen Elizabeth Grammar School, Cranbrook. He was in business as market clerk and tea-taster to a London firm of tea brokers, retiring in 1926. For some years he lived at Muswell Hill, Highgate, and later with his sisters at Church End, Finchley. He married Elizabeth Ann Austin in December 1920, and they took up residence at Herne Bay on his retirement, until owing to the infirmity of both they went to live with his sister, Mrs. Twamley, at Bedford.

From childhood Cooper was keenly interested in natural history, his specialities being Botany and Recent and Tertiary Conchology. Geology and Entomology were also favoured subjects, and at one time he had a very good collection of butterflies. These interests later gave way to the less energetic hobby of stamp collecting.

The Conchological Society, which he joined in 1892, particularly the London Branch, of which he was secretary for many years, owes a great deal to Cooper's energy and administration. He was a member of Council and became President of the Society in 1932. Cooper conducted most of the field meetings in the London area and was an assiduous and energetic worker. Sometimes all one could see of him was the lower ends of his legs and a pair of boots protruding from some hedge or herbage, this energy being often rewarded by the find of some unusual or rare form, including more than one sinistral specimen.

Cooper's collection of foreign shells was disposed of some years ago, when some members of the Society were able to acquire groups in which they were specially interested. Cooper then concentrated his attention on the fossil shells of Thanet; a collection of local Eocene shells was given to Herne Bay Museum, and a duplicate set was destined for Canterbury Museum. He also specialized on introduced alien plants, particularly in the home counties of Essex, Middlesex and Buckinghamshire; his herbarium is now in the Botanical Department of the British Museum, and numbers of specimens were also given to the Kew Herbarium.

Many friends will recall the keen and kindly interest shown by Cooper, as well as his unassuming manner in offering help, especially to new and younger members of the Society. All benefited by his experience and success in the field and often by gifts of specimens, for he was generous as well as helpful. It is difficult to realize that his membership of sixty years has now ended.

Some of the above biographical details are due to the kindness of Mrs. Twamley, who made a restful home for her brother and his wife in her own home at Bedford for the last few years. A brief obituary appeared in *Proc. Malac. Soc.* **29**, 215.

PAPERS PUBLISHED BY J. E. COOPER

Journal of Conchology.

1893. *Valvata piscinalis* monstr. *sinistrorsum* at Hunstanton, West Norfolk. **7**, 174.
Note on *Helix pisana* in the Channel Islands. **7**, 265.
1894. Notes of Dorsetshire marine shells. **7**, 435.
1898. *Valvata cristata* Müll. **9**, 119.
1899. Note on *Petricola pholadiformis* Lam. **9**, 243.
1903. *Helix pisana* var. *alba* Shuttl. in Guernsey. **10**, 299.
1905. Note on *Crepidula fornicata* L. **11**, 227.
1907. *Vertigo moulinsiana* in Middlesex. **12**, 19.
1908. *Vitrea rogersi* with pale animal. **12**, 138.
1909. *Pyramidula rotundata* m. *sinistrorsum* in Bucks. **12**, 237.
Pisidium supinum A. Schmidt living in the Thames. **12**, 294.
Crepidula fornicata L. on the coast of Kent. **12**, 315.
(With A. Loydell.) Notes on the Mollusca of the valley of the Colne. **12**, 326.
1910. Note on decollated shells. **13**, 14.
Pisidium supinum A. Schm. in Bucks. **13**, 14.
Assemania grayana in East Suffolk. **13**, 14.
Obituary: A. Loydell. **13**, 64.
Abnormal radula of *Vitrea lucida* (Drap.). **13**, 76.
1911. *Paludestrina jenkinsi* in Merionethshire. **13**, 138.
Pseudanodonta elongata Hol. in the Thames. **13**, 138.
Vertigo substriata Jeffreys in Bucks. **13**, 146.
Succinea oblonga in Merionethshire. **13**, 148.
New county records of *Pisidium*. **13**, 216.
1912. Association of *Ancylus fluviatilis* and *Velletia lacustris*. **13**, 273.
Variation in *Littorina littorea* L. **13**, 340.
1914. Monstrosities of *Tapes pullastra* and *Mactra stultorum*. **14**, 181.
1918. *Physa acuta* Drap. in Middlesex. **15**, 233.
Paludestrina jenkinsi Smith in Bucks. **15**, 275.
1922. *Physa heterostropha* Say in Middlesex. **16**, 308.
1924. Note on *Planorbis stroemi*. **17**, 119.
1927. The rate of growth in *Planorbis*. **18**, 78.
1928. *Littorina rudis* var. *tenebrosa* Mont. **18**, 204.
1929. *Planorbis laevis* Alder (= *glaber* Jeff.) in E. Suffolk. **18**, 317.
1931. *Amphipeplea glutinosa* (Müll.) in East Kent. **19**, 113.
Field notes on *Helicella virgata* da Costa. **19**, 148.
Life-history of *Myxas glutinosa* (Müll.). **19**, 180.
1932. Pearls in *Mytilus edulis* L. **19**, 259.
1933. The Mollusca of Chislet marshes. **19**, 317.
1934. Oldhaven and Thanet Sand Mollusca of Herne Bay (Presidential Address). **20**, 4.
1937. *Anodonta* in East Kent. **20**, 290.

Proceedings of the Malacological Society of London.

1895. On *Petricola pholadiformis* Lam. from Burnham-on-Crouch, Essex. **1**, 291 (exhibit).
1896. Note on the occurrence of *Petricola pholadiformis* Lamk. at Shellness, Kent. **2**, 134.
1907. Holocene Mollusca from Staines. **7**, 310.
1909. (With A. Loydell.) A preliminary list of recent Middlesex Mollusca. **8**, 219.
1913. Note on a Holocene deposit at Boveney, Buckinghamshire. **10**, 318.
1920. Additions to the list of recent Middlesex Mollusca. **14**, 5.
1922. Note on a Holocene deposit at Penton Hook. **15**, 35.
1924. Note on *Planorbis stroemi* Westerlund (= *acronicus* Férussac) living in the Thames. **16**, 15.
1925. A tentative list of Buckinghamshire Mollusca. **16**, 249.

Hardwicke's Science Gossip.

1887. An eligible building site. 189.
1889. Casual and alien plants in north London. 223.

Journal of Botany.

1914. Casual plants in Middlesex. **52**, 127.

A. E. SALISBURY.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

715th Meeting, held at the British Museum (Natural History), 18 October 1952.

The President in the chair.

Election of Members.

Werner Bolling, Luitpold-Apotheke, Luitpold-strasse 33, Bamberg, Bavaria, Germany.

Mrs. Helen Boswell, P.O. Box 8081, Johannesburg, South Africa.

Richard John Chancellor, Bells House, Cole Hill, Wimborne, Dorset.

Member Deceased.

The President announced the death of Mr. J. E. Cooper, a member of the Society for 60 years and a past President.

Communications.

"*Helix pomatia* L. at Carshalton, Surrey," by G. I. Crawford.

"The two British Species of *Carychium* Müller," by Hugh Watson and B. Verdcourt.

Exhibits.

Special exhibit: Palaearctic Unionacea.

The President: *Margaritifera durrovensis* Phillips from the type locality; *Anodonta cygnea*, Newstead Abbey; living *Hygromia cinctella* from Paignton; *Helicella elegans* collected by M. P. Kerney at Walmer, Kent.

Mr. G. A. S. Barnacle: *Paludomus* from Ceylon.

Mr. J. F. M. de Bartolomé: *Margaritifera* from Co. Cork.

Mr. C. P. Castell: fossil Unionacea from the British Museum collections.

Mr. T. Pain: European Unionidae; *Cristaria plicata herculea* Middendorff, Japan (the largest freshwater bivalve).

Mr. G. W. Pitchford: British Unionacea.

Mr. L. W. Stratton: *Hyridella* from New Zealand.

Mr. G. L. Wilkins: giant *Anodonta cygnea*, Claughton, Lancashire, from the British Museum collections.

716th Meeting, held at the British Museum (Natural History), 15 November 1952.

The President in the chair.

Election of Members.

Joshua L. Baily, Jr., A.B., A.M., Mus.B., Sc.D., 4435 Ampudia Street, San Diego 3, California, U.S.A.

Frederick James Harper, B.Sc., A.I.C.T.A., M.I.Biol., c/o Inspector-General of Agriculture, Lagos, Nigeria, B.W.A.

Communication.

" A sinistral *Achatina fulica*," by T. Pain.

Exhibits.

Special exhibit : Molluscan monstrosities and deformities ; examples were exhibited by Messrs. C. P. Castell, A. E. Ellis, T. Pain, L. W. Stratton and G. L. Wilkins, and Major R. J. Griffiths.

The President : Shells from Neolithic flint-mines at Blackpatch, near Findon, Sussex ; exceptionally large *Unio pictorum*, collected by Mr. G. W. Pitchford in the river Medan, Thoresby Park, Notts.

Mr. A. E. Ellis : *Lymnaea peregra* bred by Professor A. E. Boycott, mounted to illustrate the mode of inheritance of sinistrality.

Dr. H. E. Quick : *Oxychilus draparnaldi* with *Helix aspersa* which they had devoured.

717th Meeting, held at the British Museum (Natural History), 13 December 1952.

The President in the chair.

Election of Member.

George Jacobs, 853 Riverside Drive, New York 32, N.Y., U.S.A.

Exhibits.

Special exhibit : Mollusca extinct in the British Isles but still living abroad ; examples were exhibited by the President, Mr. C. P. Castell (from the British Museum collections) and Mr. A. E. Ellis.

Mr. T. Pain : Mollusca of Lake Albert.

Mr. G. W. Pitchford : Cuban land shells.

718th Meeting, held at the British Museum (Natural History), 17 January 1953.

The President in the chair.

Communications.

" On *Parastrophia asturiana* de Folin," by B. S. Kisch.

" Visual selection by tone of *Cepaea nemoralis* (L.)," by Dr. A. J. Cain.

Exhibits.

Special exhibit: *Oliva* and *Helicella.*

The President: *Lithology of Edinburgh*, by Rev. John Fleming, D.D., edited by J. Duns, with portrait of author (Edinburgh, 1859); *Excursions illustrative of the Geology and Natural History of the environs of Edinburgh*, by William Rhind (1836).

Rev. H. E. J. Biggs: *Helicella millepunctata* and varieties from central Persia.

Mr. C. P. Castell: Recent and Pleistocene *Helicella* from the Kennard collection.

Major R. J. Griffiths: *Helicella* (*Microxeromagna*) *stolismena* (Bgt.) and *H. conspurcata* (Drap.), Cap Ferrat, Alpes Maritimes.

Mr. T. Pain: West African *Achatina.*

Dr. H. E. Quick: Specimens and anatomical drawings of *Helicella*; European snails introduced into Australia, viz. *Helicella neglecta*, *H. virgata*, *Cochlicella ventrosa* and *Theba pisana.*

Mr. L. W. Stratton: British *Helicella.*

Mr. G. L. Wilkins: *Oliva* from the Winckworth collection; specimens to illustrate Mr. Kisch's paper.

719th (Special General) Meeting, held at the British Museum (Natural History), 21 February 1953.

The President in the chair.

The meeting was convened to consider the future of the Society's Library and Collections. It was decided that the Council should formulate proposals to be submitted at a future special general meeting of the Society.

720th (Annual) Meeting, held at the British Museum (Natural History), 21 February 1953.

The President in the chair.

Election of Member.

C. F. Hemming, B.A., Desert Locust Survey, P.O. Box 5152, Nairobi, Kenya.

Election of Scrutineers.

Rev. H. E. J. Biggs and Mr. P. Coxhead were elected Scrutineers.

Election of Auditors.

Miss M. M. Howard and Mr. G. L. Wilkins were elected auditors for 1953.

Statement of Accounts.

The Hon. Treasurer presented the audited accounts for 1952, which were adopted.

Annual Reports.

The reports of the Council, the Yorkshire Branch, the North Staffordshire Branch and the Recorders were presented and adopted.

Votes of Thanks.

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permitting the Society to hold meetings in the Museum; to the authorites of the Leeds Museum for housing the Society's library and cabinets; and to the Officers and Members of Council for their work on behalf of the Society.

Election of Officers and Council.

The Officers and Members of Council nominated by the Council were unanimously elected: *President*, A. G. Davis, F.G.S.; *Hon. Secretary*, C. P. Castell, B.Sc., F.G.S.; *Hon. Treasurer*, A. E. Salisbury, A.M.I.E.E.; *Hon. Editor*, A. E. Ellis, M.A., F.L.S.; *Hon. Librarian and Curator*, Mrs. A. Thurgood; *Hon. Recorders*, A. E. Ellis (non-marine) and Mrs. N. F. McMillan (marine); *Council*, Mrs. E. M. Morehouse, L. W. Stratton, J. F. M. de Bartolomé, W. J. Rees, D.Sc., H. F. Jones, Major R. J. Griffiths.

Presidential Address.

The President delivered an address on "The Geological History of some of our Snails, illustrated by some Pleistocene and Holocene deposits in Kent and Surrey."

Exhibits.

The President and Mr. M. P. Kerney: fossil land and freshwater shells from Swanscombe, Kent, and Oxted, Surrey.

Mr. J. F. M. de Bartolomé: series of *Helix nemoralis* from various localities on the west coast of Ireland.

Major R. J. Griffiths: *Cypraea hirasei* Roberts, Kii, Japan.

Mrs. F. G. Kellett: shells from Kuwait, Persian Gulf.

Mr. T. Pain: *Placostylus* from New Zealand.

Mr. G. W. Pitchford: large *Unio pictorum* from Thoresby Park, Nottinghamshire; shells of *Arianta arbustorum* which had been hoarded and eaten by field-mice.

Dr. H. E. Quick: European snails introduced into Australia.

Mr. L. W. Stratton: New Zealand land shells.

Report of the Council.

During the past year there has been an increase of six in membership, which now stands at 186 ordinary and two honorary members. The Society has lost five members by death, namely C. N. Bromehead, G. D. Hale Carpenter, J. E. Cooper, K. L. Pfeiffer and F. H. Solly.

Seven ordinary meetings, an annual and a special general meeting have been held at the British Museum (Natural History), by kind permission of the Trustees. The average attendance has again increased. Four field meetings were held in the neighbourhood of London. Two numbers of the *Journal of Conchology* were published, namely volume 23, number 8, issued on 6 March (dated 29 February) 1952, and number 9, issued on 27 January 1953.

Report of the Yorkshire Branch.

At the January meeting Mrs. E. M. Morehouse read a short paper on *Liguus* and *Cochlostyla*, and Mr. S. G. Appleyard dealt with the history of the phylum Mollusca in the earlier classifications of animals. On 9 February Mrs. Morehouse presented a paper on cowries, illustrated by specimens from her collection. In March a visit was paid to the Yorkshire Museum at York, where Mr. A. Wallis read a short paper on " The Bivalves of Scarborough ", and the Sowden and Hey collections were inspected. The April meeting was held in the annexe of the Leeds City Museum, where members examined the Ashford and Stubbs collections.

On 10 May a visit was paid to Harewood Park lake, where both aquatic and marginal species were very scarce, no doubt due to the presence of many waterfowl ; 14 species were taken. In June under bad weather conditions the steep slopes of Castle Hill, Scarborough, were searched, 16 species being taken. In July the disused magnesian limestone quarries at Little Smeaton and Stapleton were explored ; *Cecilioides acicula* was found here and in quarries at Cridling Stubbs. In another disused quarry at Kirk Smeaton several *Vallonia pulchella* were found, despite the quarry's present use as a poultry farm. The last field meeting was at Boston Spa, where *Pomatias elegans* is still to be found above Jackdaw Crag.

The Annual Meeting was held at Leeds on 11 October. The final meeting was devoted to a talk on " Pectens " by Mr. A. Smith and a demonstration of the making of glass-topped boxes.

S. G. APPLEYARD.

Recorder's Report : Marine Mollusca.

Monodonta lineata (da Costa) was sent alive from Port Ballintrae, Antrim, by Miss A. M. Irwin ; this is a notable extension of its known range, as hitherto this species has been deemed absent from north-east Ireland. Nothing else has been received for record.

N. F. MCMILLAN.

Recorder's Report : Non-marine Mollusca.

Even fewer new records have been received this year than last (*J. Conchol.* **23**, 303). Dr. J. O'N. Millott took *Lymnaea glutinosa* in Bala Lake, Merioneth (v.-c. 48), and *Aplexa hypnorum* among reeds in marshy ground by the lake, on 9 October 1952. *L. glutinosa* has been known from this locality for a century (Forbes & Hanley, *History of British Mollusca* **4**, 184), but has not previously been authenticated for the Census. Miss D. Rouan Dunn has sent specimens of *Pisidium lilljeborgi* from Bala Lake. Mr. A. R. Waterston records *Milax budapestensis* (= *gracilis*) from Brodick, Arran (v.-c. 100). The Rev. Canon L. W. Grensted has sent specimens of *Carychium minimum s.s.* from vice-counties 23 and 49, and *C. tridentatum* from 23, 33, 38, 49 and 98. Mr. Hugh Watson has kindly supplied the following list of vice-counties for which he has authenticated the two species of *Carychium*: *C. minimum s.s.*: 1, 2, 7, 9, 17, 18, 27, 29, 30, 35, 41, 58, 59, 62, 67, 69, 81, 82, 99, 104, 106, 125, 130, 131, 140S; *C. tridentatum*: 1, 2, 5, 7, 8, 9, 14, 17, 18, 21, 24, 27, 29, 30, 32, 35, 41, 45, 48, 56, 58, 59, 62, 66, 67, 83, 99, 101, 106, 125, 126, 130, 131, 140S, 146M, 147.

A. E. E.

721st Meeting, held at the British Museum (Natural History), 21 March, 1953.

The President in the chair.

Member Deceased.

The President reported the death, on 27 February, of Dr. W. F. Buckle.

Communication.

"On mites parasitizing *Anodonta* in England," by R. D. Mitchell and G. W. Pitchford.

Exhibits.

Special exhibit: Chitons and *Helicostyla*.

Mr. C. P. Castell: fossil Chitons from the British Museum collections.

Major R. J. Griffiths: South African cowries.

Mr. H. F. Jones: Australian cowries.

Mr. T. Pain: *Helicostyla* from Philippine Islands; sinistral *Helix pomatia* from Box Hill and Ranmore Common, Surrey.

Dr. H. E. Quick: water-colour paintings of living *Tortulosa* from Ceylon.

Mr. G. L. Wilkins: Chitons from the Winckworth collection.

ACCOUNTS FOR THE YEAR ENDING 31st DECEMBER 1952.

Income and Expenditure Account.

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
,, Paid in 1951	8	13	0			
,, For 1952	103	9	0			
,, Arrears	30	0	0			
,, Donations	3	2	0	145	4	0
,, Sales				75	19	6
,, Transfer from Life Membership Fund				25	2	9
				£246	6	3

Cr.

	£	s.	d.	£	s.	d.
By Publication and Distribution—						
Journal, vol. 23, pt. 8	112	13	6			
Society's Rules	4	0	1	116	13	7
,, Printing and Stationery	4	11	0			
	5	4	0			
	3	8	3	13	3	3
,, Fire Insurance				1	0	0
,, Subscription—						
Zoological Record					8	0
Zoological Society				2	0	0
,, Officers' Expenses				9	7	4
,, I.R. Stamp					5	10
,, Cheque Book					4	0
,, Reserve Fund				100	0	0
Balance, being excess of Income over Expenditure				3	4	3
				£246	6	3

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1952	489	14	0
,, Composition Fee	20	0	0
,, Dividends and Interest	25	2	9
	£534	16	9

	£	s.	d.
By transfer to Income and Expenditure Account	25	2	9
,, Amount of Fund, 31 December 1952	509	14	0
	£534	16	9

Research and Reserve Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1952	156	16	0	By Amount of Fund, 31 December 1952	364	18	0
,, Repayments as per Resolution carried at General Meeting	100	0	0				
,, Income and Expenditure Account	100	0	0				
,, Dividends and Interest	8	2	0				
	£364	18	0		£364	18	0

BALANCE SHEET.

Liabilities.	£	s.	d.	£	s.	d.	Assets.	£	s.	d.	£	s.	d.
Anunal Subscriptions in advance				10	17	9	4% Funding Loan (cost)	350	0	0			
Life Membership Fund				509	14	0	2½% Defence Bonds (cost)	200	0	0			
Research and Reserve Fund				364	18	0	3½% War Loan (cost)	40	0	0	590	0	0
Balance from Income and Expenditure Account—													
As on 1 January 1952	367	0	10				Cash at Bankers—						
For 1952	3	4	3	370	5	1	National Provincial Bank	303	3	7			
							Post Office Savings Bank	354	11	3			
							Cash in hand	8	0	0	665	14	10
				£1,255	14	10					£1,255	14	10

NOTE.—Assets in addition to those set out in the above Balance Sheet are (*a*) Library, (*b*) Cabinets and Collections, (*c*) Stock of unsold Publications, (*d*) Annual Subscriptions in arrears.

Examined and found correct.
G. L. WILKINS,
M. M. HOWARD.
6 February 1953.

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Hon. Treasurer.
24 January 1953.

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(*April*, 1953.)

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1930 }
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1952 Chancellor, R. J., Bells House, Cole Hill, Wimborne, Dorset.
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1947	Fez y Sanchez, Dr. Siro, Conde Salvatierra de Alava 21, Valencia, Spain.
1915	Firth, J. D., F.R.E.S., 347 Otley Road, Weetwood, Leeds 6.
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1909 1939	Haas, Dr. F., Chicago Natural History Museum, Roosevelt Road and Field Drive, Chicago 5, Illinois, U.S.A.
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1951	Pakistan Government Zoological Survey Department, 183 McLeod Road, Ispahani Building, Karachi 1, Pakistan.
1941	Palmer, R. E. (*address not known*).
1947	Pantin, J. H., 25 Bentley Road, Cambridge.
1948	Parodiz, Dr. J. J., c/o Museo Nacional de Historia Natural, Buenos Aires, Argentina.
1919 L	Paton, Mrs. B. J., Tywyn, Weybourne, Norfolk.
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1938	San Diego Society of Natural History, Balbao Park, San Diego, California, U.S.A.
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1886 H P	Tomlin, J. R. le B., M.A., F.R.E.S., 23 Boscobel Road, St. Leonards-on-Sea, Sussex.
1949	Tromsø Museum (Zoologisk Ard.), Tromsø, Norway.
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1948	Universitetets Zoologiske Museum, Copenhagen, Denmark.
1951	University College of N. Wales (Science Library), Bangor, Caernarvonshire.
1946	Venmans, Dr. L. A. W., c/o Wahlmann and Co., Delft, Holland.
1943	Verdcourt, B., E. African Herbarium, P.O. Box 5166, Nairobi, Kenya.

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1937	Yorkshire Philosophical Society (York and District Field Naturalists' Section), The Museum, York.
1947	Zárate y López, Dr. A. O. de, Najera, Prov. Logroño, Spain.
1937 1950	Zilch, Dr. A., Senckenberg Museum, Senckenberg Anlage 25, Frankfurt-am-Main, Germany.

FIELD MEETINGS, 1952.

Field Meetings were held at Hackhurst Downs, Surrey, 31 May, and at Penton Hook, 16 August, under the leadership of the President, at Aldenham, Herts, 5 July, leader Mr. L. W. Stratton, and at Kew, Surrey, 27 September, leader Mr. G. L. Wilkins.

At Hackhurst Downs the lower slopes were well populated with *Helix pomatia*, while the coarser vegetation yielded over 20 species, including *Cochlicopa minima.* In the woods on the higher part of the downs *Helicigona lapicida* and *Marpessa laminata* were numerous on the trunks of beeches. The watercress beds at Gomshall were also visited, where *Lymnaea peregra*, *L. palustris*, *Planorbis planorbis*, *P. vortex*, *P. contortus* and *Potamopyrgus jenkinsi* were taken, and on the adjacent marshy ground *Zonitoides nitidus*, *Arianta arbustorum*, *Helix hortensis* and *Succinea.*

At Penton Hook *Anodonta anatina* and *Unio tumidus* were found in quantity, with a few *Anodonta minima.* A single example of *Dreissena polymorpha* was obtained, attached to *A. anatina.*

The meeting at Kew was held to investigate the present condition of the moat between the wall of the Royal Botanic Gardens and the tow-path. The water in the moat was formerly almost on a level with the tow-path and rich in Mollusca, but in recent years the path has been raised about five feet, the moat cleaned out and the retaining walls treated with preservative. Few species have survived this treatment, but opposite Sion House, where the moat does not appear to have been recently cleaned, small numbers of Mollusca representing several species were obtained. *Planorbis vortex* was the most plentiful, with a few *Sphaerium corneum*, *Bithynia tentaculata*, *Lymnaea peregra*, *L. stagnalis*, and a *Physa* assumed to be *heterostropha.*

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MOLLUSKS

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ON THE GEOLOGICAL HISTORY OF SOME OF OUR SNAILS, ILLUSTRATED BY SOME PLEISTOCENE AND HOLOCENE DEPOSITS IN KENT AND SURREY.

By A. G. DAVIS, F.G.S.

(*Presidential Address, delivered at the Annual Meeting,* 21 *February* 1953.)

The geological history of our native land and freshwater Mollusca was the special field of our late member and past President A. Santer Kennard, and in this address I hope to pay a tribute to his memory. His literary output was vast when it is remembered that his studies were confined to his leisure hours. His unpublished work is almost of equal extent, and it is fortunate that his MSS., together with an unrivalled amount of voucher material, are preserved in the Geology Department of the British Museum (Natural History). Had he lived a little longer I believe he would have published his work on the Mollusca of Swanscombe and given us a memoir similar in scope to his Crayford Brickearths (1). With his usual generosity he gave the fruits of his labours at Swanscombe to Zeuner (2), who presented them in a manner which does not give the provenance of many of the species. The lack of a detailed fauna of the Swanscombe complex has already made itself felt to new students, and to meet this need, Kennard's records, made over a period of nearly 50 years, are available. Mr. W. N. Edwards, Keeper of Geology, British Museum (Natural History), has most kindly given me permission to publish Kennard's MS. records, and these are now submitted in the tabular list almost as he wrote them. I have only amended the nomenclature in accordance with the Society's latest census [Ellis (3)], and added new records as a result of work I have done on the sequence in the last three years. The species are listed under the appropriate horizons and localities comprising the Swanscombe complex. A concise account of the latter has been given recently by Oakley (4) together with a bibliography of some 60 titles.

It is necessary before coming to the faunal list to comment briefly on the localities and horizons concerned.

Ingress Vale, Greenhithe, Kent. Also known as Dierden's or the Greenhithe Shell pit, this is situated opposite the Ingress Tavern and about 470 yards N.W. of Barnfield Pit. The site has been built over and occupied by Dierden's stables for many years past. Shells, the first to be discovered in the High Terrace deposits, were recorded from here by Stopes (5) in 1900; 44 species were determined by Kennard. In the following year Kennard and Woodward (6) increased the list to 47 and deduced from them that the climate was temperate and that the stream was a quickly flowing one. The characteristic species present are *Theodoxus cantianus* in great abundance, *Valvata antiqua* in millions, *Corbicula fluminalis* abundant and *Viviparus diluvianus* common. This assemblage in numbers is not met with at the Barnfield pit. In severely reduced numbers they are associated with the Channel deposits and *V. diluvianus* has never been found there [Kennard (14)].

Mr. S. Priest has informed me (in lit. 6/2/53) that the shell bed in considerable thickness was exposed during drainage operations in Knockhall Road in 1921. For the purpose of making fresh collections, Mr. Michael Kerney and myself opened up the shell bed in a narrow vacant plot at the back of Dierden's stables in 1952, with the kind permission of the owner, Mrs. Dierden.

Rickson's Pit. Situated ½ mile E. of Barnfield Pit. The site is now worked out and was described by Dewey (7), who recorded 7 species. *Theodoxus cantianus*, *Valvata antiqua* and *Corbicula fluminalis* were abundant, and the fauna is so similar to that of Ingress Vale that it is here included with the Channel horizon of Barnfield Pit.

Barnfield Pit, Swanscombe, Kent, is situated ½ mile N.W. of Swanscombe Church and on the west side of Craylands Lane. It has been worked for gravel for many years and in reaching its present extent has absorbed earlier excavations including one known as Collyers Pit. The locality became famous for the vast numbers of stone implements obtained there, but that fame has been eclipsed by the discovery in 1935 of the remains of Swanscombe Man by Mr. Alvan T. Marston. There are three well-marked horizons and each has its own distinctive molluscan fauna.

3 Upper Middle Gravel, also referred to as the Channel.
2 Lower Middle Gravel, also referred to as the Older Middle Gravel.
1 {The Lower Loam.
{The Lower Gravel, also referred to as Basal Gravel.

Kennard (9) in summarizing four years' work he had then completed in the Barnfield Pit, concluded from his study of the Mollusca that when No. 1 was deposited, the Thames and the Rhine were separate rivers, but in the interval between 1 and 2 the Thames and the Rhine were connected and the Rhine species were able to colonize the Thames, this colonization being more marked in 3. Each interval is separated by great lapses of time.

These deposits belong to the High Terrace of the Thames and are often referred to as the 100 foot Terrace or the Boyn Hill Terrace.

The Lower Gravel.

A list of the Mollusca from this horizon, determined by Kennard, is given by Zeuner (2), but the list includes all the shells of the Lower Loam. They are given separately in the Kennard MS. 43 species are present including 10 extinct forms.

The Lower Loam.

King and Oakley (10) regard this as being laid down as fine muddy silt from slowly moving or stagnant water in reedy swamps, at a time when the main stream had swung to the north side of the valley. Dewey (7) records 8 species from here. Zeuner's list (2) is a composite one of the two faunas. *Ena montana* is commoner here than in the Lower Gravel, and it indicates that part of the terrain in the stream's course was in calcareous woodland, almost certainly beech forest. *Truncatellina britannica*, a new record, is also present ; it favours bleak situations and there may have been such an area between the forest and the swamp. *Helix nemoralis* is abundant both at the top and the base of the bed and is larger than average Kentish recent examples, indicating that warmer summers than are now experienced must have prevailed. Species of *Vertigo* occur and belong to the swamp vegetation. Swanscombe Man varied his diet no doubt with an occasional repast of *H. nemoralis* and *Potomida littoralis* which abounded.

Recent tidying up operations in the floor of the pit have revealed fresh exposures of the Lower Gravel and Lower Loam, and in 1951–52 Mr. M. Kerney and myself made large collections and a number of new records are incorporated in the faunal list. In addition to the species listed, there were a few valves of a *Pisidium* which Mr. Ellis was unable to identify, and of which Mr. Stelfox wrote, " I am wondering if you should not consider the possibility of their being a species unknown to us and perhaps extinct." M. Jules Favre had never seen anything like them before. Search will be made for more examples of this puzzling form.

The Older Middle Gravel.

In these gravels were found *Belgrandia marginata*, *Theodoxus cantianus* 1 example, and *Valvata antiqua* 3 examples [Kennard (12)], which indicate the arrival of the Rhenish species.

The Upper Middle Gravel (= The Channel).

This is the phase when a channel was formed which cut through the Older Gravel, the Lower Loam and the Lower Gravel. The Swanscombe Skull was discovered in this deposit. Kennard (12 and 16) recorded 13 species and in his MS. he has entered under the fauna of the Channel those species recorded by Dewey (7) as being from the Lower Gravel. Chandler (11) found abundant *Theodoxus cantianus* in a part of the succession at Barnfield Pit, and from a study of his descriptions of sections then visible it can only be concluded that this find belongs here. Kennard in 1944 (1, p. 161), in presenting his conclusions on the sequence of the High Terrace at Swanscombe, placed with the Upper Middle Gravels " Marston's Channel, shelly gravels in Dierden's and Rickson's pits ".

Later work on these deposits has shown that the frequencies recorded by Kennard give, in general, an accurate picture. Facilities for collecting at Ingress Vale are severely restricted, yet a cubic yard of the shell bed yielded 55 of the 77 species recorded by Kennard and included 4 forms not found by him. It would appear that the present exposures of the Lower Loam are richer than any seen by him and that the Lower Gravel

MOLLUSCA OF THE SWANSCOMBE HIGH TERRACE.

	Lower Gravel	Lower Loam	Older Middle Gravel	Channel	Ingress Vale	Rickson's Pit
Theodoxus cantianus Kennard and Woodward		7N	1	X	A	C
Viviparus diluvianus (Kunth)					C	
Valvata cristata Müller	8	1			36	6
,, *piscinalis* (Müller)		1	1			
,, *andreana* Menzel	C	2	A		8	6
,, *naticina* Menke				X	C	6
,, *antiqua* Morris			3	5	A	A
Paladilhia radigueli (Bourguignat)					10	
Belgrandia marginata (Michaud)			10		C	35
Bithynia tentaculata (Linné)	A	C	C	11	A	C
,, *inflata* (Hansén)	9			4	26	2
Carychium minimum Müller		3			4	
,, *tridentatum* (Risso)	2	20			4N	
Lymnaea truncatula (Müller)	11	1	10		40	1
,, *palustris* (Müller)	3				8	1
,, *stagnalis* (Linné)	3				3	
,, *peregra* (Müller)	A	C	A	X	24	20
,, *monnardi* (Hartmann)	A		6	7	32	6
Planorbarius corneus (Linné)	1				1	
Planorbis carinatus (Müller)	C	1		X	37	
,, *planorbis* (Linné)					1	
,, *vorticulus* Troschel					5	
,, *vortex* (Linné)	1				3	
,, *leucostoma* Millet	2	2			3N	
,, *laevis* Alder	1		2		28	6
,, *albus* Müller	16			X	C	18
,, *acronicus* Férussac		1N				
,, *crista* (Linné)	10	5			C	2
,, *contortus* (Linné)					28	1
Segmentina complanata (Linné)	1	1			20	1
Acroloxus lacustris (Linné)					1	1
Ancylus fluviatilis Müller	A	16	A	3	C	12
Succinea pfeifferi Rossmässler	2	23	40	1	30	3
,, *elegans* Risso	X					
Succinea putris (Linné)					1	
Azeca goodalli (Férussac)	3	10			1	
Cochlicopa lubrica (Müller)	10	A			2	2
Truncatellina cylindrica britannica Pilsbry		36N				
Vertigo pusilla Müller		8				
,, *antivertigo* (Draparnaud)		1N			2	
,, *pygmaea* (Draparnaud)		24N			1	
,, *angustior* Jeffreys		13N				
Pupilla muscorum (Linné)		10	1		2	
Acanthinula aculeata (Müller)		1				
Vallonia costata (Müller)	X	X			14	
,, *pulchella* (Müller)		38N			4	
,, *excentrica* Sterki	X	C	X		6	
,, *tenuilabris* (H. Braun)	X	X	1			
Ena montana (Draparnaud)	5	C				
Marpessa laminata (Montagu)					6	
Clausilia bidentata (Ström)		1			20	3
,, *pumila* C. Pfeiffer		2			3	

	Lower Gravel	Lower Loam	Older Middle Gravel	Channel	Ingress Vale	Rickson's Pit
Clausilia ventricosa (Draparnaud)	10	1				1
Balea perversa (Linné)		4N				
Cecilioides acicula (Müller)					6	
Helicodonta obvoluta (Müller)					1N	
Arianta arbustorum (Linné)	2	6			2	1
Helix nemoralis Linné	C	C			40	3
Hygromia hispida (Linné)	A	A	C	C	20	16
Monacha granulata (Alder)					10	
Helicella crayfordensis Jackson	48	6		1	17	
Punctum pygmaeum (Draparnaud)	1	40			1	
Discus ruderatus (Férussac)	33	A			3	1
,, *rotundatus* (Müller)		1			16N	
Arion sp.		1			6	
Vitrea crystallina (Müller)	1	5			5	
Retinella radiatula (Alder)	3	40			2	
,, *nitidula* (Draparnaud)	9	40			3	
Zonitoides nitidus (Müller)	19	30			4	
Vitrina sp.		6			3N	
Limax sp.	3	3			2	1
Unio pictorum (Linné)			1		C	1
,, *tumidus* Retzius					C	1
,, *cantianus* Kennard and Woodward *			A		C	14
Potomida littoralis (Cuvier)	A	C	2	X	C	22
Anodonta anatina (Linné)	2					1
Sphaerium rivicola (Lamarck)			3			
,, *corneum* (Linné)	A	C	34	8	30	20
,, cf. *solidum* (Normand)			10			
Corbicula fluminalis (Müller)				X	A	C
Pisidium amnicum (Müller)	A	16	A	7	C	31
,, *clessini* Neumayr			4	X	C	20
,, *casertanum* (Poli)	5N	1N			A	
,, *personatum* Malm					C	
,, *obtusale* (Lamarck)					1	
,, *milium* Held	2N	7N			6	
,, *subtruncatum* Malm	18N				25	
,, *supinum* Schmidt					20	
,, *henslowanum* (Sheppard)	CN	56N			C	1
,, *hibernicum* Westerlund		1N			6	
,, *nitidum* Jenyns	29N	78N			60	
,, *pulchellum* Jenyns	1N					
,, *moitessierianum* Paladilhe	1N	6N			57	
,, *tenuilineatum* Stelfox	1N				2	
Ova of Helicidae : ? *H. nemoralis* 29 ? *H. hispida* 20		49N				
Number of species	45	52	24	18	79	38

Total number of species : 94.
A = abundant (over 500 examples).
C = common (100–500 examples).
X = numbers unknown.
N = new record (A. G. Davis and M. Kerney, 1951–52).

* Referred by F. Haas, 1940, *Zoological Series of Field Museum of Natural History* **24**, 131, to *U. crassus* Philipsson.

is very poor compared with the rich lenticles formerly available. Kennard's MS. of the Swanscombe fauna was probably drawn up soon after he had completed his four years' work in Barnfield Pit [Kennard (9)].

Notes on some of the Species.

Theodoxus cantianus is unique in that it is unknown apart from the Swanscombe deposits, but it is extremely like and may be identical with *T. prevostianus* (C. Pfeiffer). This occurs in the thermal waters of the Middle Danube basin in Hungary as well as in Croatia, Slavonia and Lower Austria. At the bath of Puspokfurdo living *T. prevostianus* occur, while in the sediments of the bath and deposits near by an extinct form, forma *adelae* Brusina (19) is found which Soós (17 and 18) regards as being inseparable from *T. prevostianus* and at most an ancestral form. Specimens from Tata and Puspokfurdo have a yellow ground colour (like some of the Swanscombe shells) but at other localities it has a black or lilac ground colour. At Swanscombe lilac and black forms occur in the proportion of 1 per 1,000. Soós introduced yellow forms into the Roman bath at Budapest (Aquincum) in 1907 and by 1925 these had become abundant but all had taken on the black ground colour.

Are thermal waters the answer to the unique occurrence of *T. cantianus* at Swanscombe ? Such a phenomenon is not unknown in England, for a Holocene deposit in the Roman bath at Bath (Aquae Sulis) has yielded Mollusca and strangely enough the fauna included *Potamopyrgus jenkinsi* (Smith), the origin of which in Britain is the subject of controversy at the present time.

Kennard and Woodward found an imperfect operculum of *T. cantianus*, but in the course of the present investigation more than a dozen perfect examples have come to light.

The record in the Lower Loam is based on a number of fragments, which were found in the weathered top of the deposit and may be derived.

Planorbis acronicus. First record for the 100 ft. Terrace. Only a single example was found in the Lower Loam. It is known from the Lower Pleistocene of Germany and the 30 metres Terrace of the Somme at Thennes.

Truncatellina cylindrica britannica. New to the Swanscombe deposits. Broken specimens revealed a denticle set well back from the peristome.

Vertigo angustior. Unknown previously from the Swanscombe deposits but is known from the Lower Pleistocene of Germany. It inhabits the margins of marshy reedy tracts.

Balea perversa. A woodland form not previously recorded from the 100 ft. Terrace.

Helicodonta obvoluta. The identification is based on two lip fragments and is the first indication of its presence in gravels older than the Upper Pleistocene in England or France. It is present in the Lower Pleistocene of Germany. Its presence at Ingress Vale suggests woodlands subject to flooding possibly in the higher reaches of the stream. It reached its widest distribution in England in Bronze and Roman times. At the present time it is distinctly a waning species, its former strongholds being yearly diminished as our beech forests are destroyed.

Ena montana. Rare in the Lower Gravel and common in the Lower Loam ; its distribution past and present and its ecology are similar to *H. obvoluta* but it seems to have the greater antiquity of the two.

Vallonia tenuilabris. See Zeuner (2) and Breuil (15). The record requires confirmation, as specimens have not been traced in Kennard's collection.

Planorbis albus. Kennard says in Breuil (15) that many of the Ingress Vale shells are distinctly keeled and should be referred to *P. stelmachoetius* Bourguignat. It is present in the 30 metres Terrace of the Somme at Thennes.

Corbicula fluminalis. Kennard had much to say about this species and it may only be remarked here that evidence has recently been found confirming his explanation of the presence of *C. fluminalis* in quantity in marine deposits, namely as at March and Kelsey Hill, as being derived from freshwater beds. At Stutton, Suffolk there is a modern beach upon which are cast up daily large numbers of *C. fluminalis*, which are extracted by tidal action from a freshwater shell bed exposed at low water. Also cast up on the beach are similar numbers of modern marine shells, *Mya*, *Cardium*, *Mytilus*, etc. Shells of *C. fluminalis* are strong and very resistant and can withstand a large amount of attrition and ill-usage on a gravelly beach. Such a beach is practically a simulation of the March and Kelsey Hill phenomena.

A Holocene deposit at Oxted, Surrey.

Holocene hill or rain washes are very prevalent on limestone tracts. Kennard (13), who has described many of them, attributed their origin to the destruction of the forests which once mantled the chalk downs. The loss of cover permitted the erosion of the humus and subsoil and the formation of a chalky sludge, which was deposited lower down the hillside or at the foot of the escarpment. In these deposits are often preserved remains of the Mollusca formerly populating the forest. Datable objects found in these deposits show that they may be of Iron to post-Roman age.

One of these deposits has been investigated by Mr. M. Kerney and myself since 1949 and is of sufficient interest to place on record. The site is exposed in the adit at the east end of the Oxted lime works, below Flint House Farm, in the road descending the face of the escarpment, and shows 2 to 3 feet of hill wash in the form of hard compacted sludge resting on shattered Lower Chalk at *ca.* 550 ft. O.D. The full upward extent of the deposit could not be studied, for it had been removed by quarrying and covered by tipped material.

From the deposit 39 species are here recorded and the assemblage indicates that the most favourable conditions for snails were present, lime, cover and humidity. From a survey of the topography and the nature of the deposit, it is clear that this assemblage is a cross section of the snail population of the former woodland, with no streams to bring in outsiders, and is in a concentrated and altered form, a relic of the former land surface of a part of the hill which is still visible from the site where it now lies buried. Less than half the number of species live in the vicinity at the present time and these in reduced numbers. Titsey Plantation, 2 miles

Faunal List, Holocene, Oxted, Surrey.

Pomatias elegans (Müller)	A
Carychium tridentatum (Risso)	A
Acme fusca (Montagu)	A
Azeca goodalli (Férussac)	28
Cochlicopa lubrica (Müller) *	C
Vertigo pygmaea (Draparnaud)	51
Pupilla muscorum (Linné)	78
Lauria sp.	2
Abida secale (Draparnaud)	3
Acanthinula aculeata (Müller)	C
Vallonia excentrica Sterki	17
Vallonia spp.	C
Ena montana (Draparnaud)	41
Ena obscura (Müller)	6
Marpessa laminata (Montagu)	23
Clausilia bidentata (Ström)	63
Clausilia rolphi Turton	C
Cecilioides acicula (Müller)	46
Helicodonta obvoluta (Müller)	56
Helicigona lapicida (Linné)	14
Arianta arbustorum (Linné)	23
Helix hortensis Müller	25
,, *nemoralis* Linné	35
Hygromia striolata (C. Pfeiffer)	C
,, *hispida* (Linné)	65
Helicella itala (Linné)	42
Punctum pygmaeum (Draparnaud)	66
Discus rotundatus (Müller)	A
Arion sp.	A
Euconulus fulvus (Müller)	5
Vitrea crystallina (Müller)	C
Oxychilus cellarius (Müller)	33
Oxychilus helveticus (Blum)	2
Retinella radiatula (Alder)	22
Retinella pura (Alder)	80
Retinella nitidula (Draparnaud)	C
Vitrina pellucida (Müller)	6
Limax maximus Linné	6
Limax spp.	52

A = Abundant, over 500 examples.
C = Common, 100 to 500 examples.
Fragmentary but determinable examples are included in the totals

* Including *C. minima* (Siemaschko).

eastward, is the nearest locality with a woodland snail fauna at all comparable and here only 25 of the Oxted list survive. The conditions are excellent and the habitat is sited similarly to that which formerly existed at Oxted ; some old timber still remains and there is excellent cover supporting a population of *Clausilia rolphi* which has been there probably throughout Holocene times.

Notable absentees from the Oxted list are *Helix pomatia* which lives on the site, *H. aspersa*, *Monacha cantiana*, *Helicella virgata*, *H. caperata* and *H. gigaxi* which live in the vicinity. Some of these are post-Roman invaders, and this supports the suspicion that the Oxted Hill wash is of

Iron age. No datable objects were found ; some fragments of charcoal are present and it may be that the forest was destroyed by fire. An example of *H. pomatia* was found during the collecting but it was traced to a rabbit burrow. *H. aspersa* and *M. cantiana* occur rarely, a few inches from the top of the deposit, but these are not included in the list as they are most probably later introductions. *Monacha cartusiana*, which occurs in many hill washes in Surrey and Kent, was absent ; it is a downland form and it is possible that there was too narrow a strip of down in front of the forest to support many downland species.

A main contributory cause of the extinction of so many interesting species was no doubt the destruction of the forest ; for those that survived, there have been centuries of man's interference—agriculture, planting, quarrying and lime burning.

An almost identical fauna, 35 species, has been recorded from a deposit of Beaker age, at Easton Down, Wilts. Kennard (21) says this is a remarkable fauna and is not equalled in England. It was the result of some years of work by a team of archaeologists working over an area of some 150 sq. yards and included five different levels. The fauna of Oxted is the more remarkable for it was restricted to a single horizon from which, owing to local circumstances, it was only possible to extract a few cubic feet of material for examination.

Notes on some of the Species.

Ena montana. This has not been met with since two examples were discovered in a similar deposit over 50 years ago at Colley Hill, Reigate. Living colonies have never been recorded from Kent, the nearest at the present time being at Great Missenden, Buckinghamshire, and Miscombe Hanger on the borders of Hampshire and Sussex. There is an old record, unconfirmed, for Godalming, Surrey.

Helicodonta obvoluta. Not known living in Kent or Surrey. It has not been found in the rich Holocene faunas of Kent but from the Holocene of Surrey there are now five records which include Reigate, Betchworth, Epsom, and Norbury Park, Mickleham. Among the Oxted specimens were a number of juveniles of two to three whorls.

Abida secale. Not recorded living in West Kent and it has but a precarious hold in East Kent. The Surrey records, Farleigh Heath and Hackhurst Downs, near Gomshall, need confirmation. It is known from the Upper Pleistocene of Halling and Folkestone, Kent. Only three examples were found in the Oxted deposit ; these were apical fragments and suggest that they had not reached maturity. All the other members of the Oxted fauna are fully developed. Since Upper Pleistocene times it would seem that this species has had a struggle to survive in the Kent-Surrey province, perhaps the winter temperatures were inimical.

Lauria sp. Two damaged examples, but which between them show all the essential characters of the shell, seem to be unlike our British forms. It has much of the appearance of *L. semproni* (Charpentier), which has never been recorded recent or fossil here, but until comparison can be made with Continental examples, a determination cannot be made. *L. semproni* occurs in association with such species as *Ena montana* and *H. obvoluta.*

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REFERENCES.

(1) KENNARD, A. S., 1944. The Crayford Brickearths. *Proc. Geol. Assoc.* **55,** 121–169.

(2) ZEUNER, F., 1945. The Pleistocene Period. *Ray Society, London.* 269–273.

(3) ELLIS, A. E., 1951. Census of the distribution of British non-marine Mollusca. *J. Conchol.* **23,** 171–244.

(4) OAKLEY, K. P., 1952. Swanscombe Man. *Proc. Geol. Assoc.* **63,** 271–300.

(5) STOPES, H., 1900. On the discovery of *Neritina fluviatilis* with a Pleistocene fauna. *J. Roy. Anthrop. Inst.* **29,** 302–3. Second edition of this paper, 1901, *J. Roy. Anthrop. Inst.* **30,** 302–3, with an extended faunal list.

(6) KENNARD, A. S., and B. B. WOODWARD, 1901. The Post-Pliocene non-marine Mollusca of the South of England. *Proc. Geol. Assoc.* **17,** 213–260.

(7) DEWEY, H., 1932. The Palaeolithic Deposits of the Lower Thames Valley. *Q. J. Geol. Soc.* **88,** 35–56.

(8) MARSTON, A. T., 1937. The Swanscombe Skull. *J. Roy. Anthrop. Inst.* **67,** 339–406.

(9) KENNARD, A. S., 1942. Faunas of the High Terrace at Swanscombe. *Proc. Geol. Assoc.* **53,** 105.

(10) KING, W. B. R., and K. P. OAKLEY, 1936. The Pleistocene Succession in the lower parts of the Thames Valley. *Proc. Prehist. Soc. E. Anglia,* **2,** 52–76.

(11) CHANDLER, R. H., 1940. On the Clactonian Industry at Swanscombe. *Proc. Prehist. Soc. E. Anglia* **6,** 79–116.

(12) Report on the Swanscombe Skull, 1938. *J. Royal Anthrop. Inst.* **68,** 17–98.

(13) KENNARD, A. S., 1923. The Holocene non-marine Mollusca of England. *Proc. Malac. Soc.* **15,** 241–259.

(14) KENNARD, A. S., 1916. The Pleistocene Succession in England. *Proc. Prehist. Soc. E. Anglia* **2,** 249–267.

(15) BREUIL, H., 1952. Glanes conchyliologiques en France (Nord et Sud-Ouest), determinées par A. S. Kennard. *Congrès préhist. de France.* XIII Session, Paris. 1950. 191–240.

(16) BATE, D. M., 1937. Note on recent finds of *Dama clactoniana* in London and Swanscombe. *Proc. Prehist. Soc.* **3,** 460–63.

(17) SOÓS, L., 1906. On Hungarian Neritinae. *Ann. Mus. Nat. Hungarici.* **4,** 450–62.

(18) SOÓS, L., 1927. Néhány faunisztikai és ökologiai adat. *Allattani Kozlemenyek.* **24,** 60–70. English translation 110–112.

(19) BRUSINA, S., 1902. Eine subtropische Oasis in Ungarn. *Mitt. Nat. Ver. Steirmark.*

(20) KENNARD, A. S., and B. B. WOODWARD, 1924. Nomenclatorial notes relating to British non-marine Mollusca, 3. *Proc. Malac. Soc.* **16,** 125–137.

(21) KENNARD, A. S., 1933. In J. F. Stone, Excavations at Easton Down, Winterslow. *Wilts. Arch. Nat. Hist. Mag.,* **46,** 225–242.

ON MITES PARASITIZING *ANODONTA* IN ENGLAND.

By R. D. Mitchell (University of Michigan) and G. W. Pitchford.

(*Read before the Society*, 21 *March* 1953.)

Five genera of water-mites are known to parasitize freshwater mussels, all of which are assigned to the family Unionicolidae. *Vietsatax* Uchida & Imamura is known from Japan, *Najadicola* Piersig from North America, and two genera, *Polyatacides* Lundblad and *Atacella* Lundblad, are South American. These poorly known genera of limited distribution need not be considered here. Members of the cosmopolitan genus *Unionicola* Haldeman are the commonest and most widespread water-mites parasitizing freshwater mussels. It appears that a great many of the Unionidae are regularly parasitized by one or more species of *Unionicola.*

There are several reasons for thinking that the species of *Unionicola* have acquired the parasitic habit within relatively recent time. First of all, many are free-living for much of their life. *Unionicola crassipes* (Müller) lives free in the nymph and adult [1] stage, and many other species recorded only as free-living are probably not parasitic in the adult stage. Other species of *Unionicola*, such as the parasites on *Anodonta* discussed below, are hardly ever captured outside of their host. Studies of North American *Unionicola* (Mitchell: unpublished) indicate that such species are probably distributed from host to host in the early period of larval life. The remaining stages of the life history, the nymph and adult, are spent within a single host. Thus it seems that the *Unionicola* first used the mussel only as a protected place for oviposition, or as shelter during the quiescent stages of metamorphosis. The persistence of this in some species has developed into a parasitic habit involving all but the early larval stages. This great variation among the closely related species of *Unionicola* as to the nature and extent of parasitism indicates the habit to be of fairly recent origin.

Studies of the taxonomy of parasites and their hosts will sometimes give evidence as to the relative ages of the two groups involved. There is adequate evidence that many parasites of vertebrates have been associated with their hosts over a long period of time. As a result certain parasites of one group of host animals will be related phyletically to each other and limited to hosts of that one phyletic line. Therefore the relative age of a group of parasites showing such occurrence may be postulated to be roughly equal to the age of the group of animals it parasitizes. This type of association has not been demonstrated in the Unionicolidae. An example of host association found in the Unionicolidae is the North American *Najadicola ingens* (Koenike), which is known to parasitize mussels belonging to different subfamilies: *Elliptio complanatus* (Dillwyn) (Unioninae), *Anodonta cataracta* Say (Anodontinae), and *Lampsilis radiata* (Gmelin) (Lampsilinae) (Humes and Jamnback 1950). In each of the three genera just mentioned there are several species closely related to the parasitized mussel that are, even in waters where *Najadicola* occurs, immune to parasitism by *Najadicola*. Cases of host association not reflecting any phyletic association seem typical of the Unionicolidae, thus indicating that there has been no long-term host-parasite association. Instead, the parasitic habit and host specificity have evolved since the origin of the host species, and adaptation has occurred with reference to biological features of the host that do not, in most instances, limit related species of *Unionicola* to particular phyletic groups of freshwater mussels.

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[1] Like most water-mites *Unionicola* pass through three life history stages subsequent to the egg: the six-legged larva, the eight-legged but sexually immature nymph, and the adult.

Although phyletic relationships of the hosts are not indicated by data on parasites, basic differences between hosts are shown. It is clear, for instance, that when two mussels show consistent differences in their parasites, there is some biological difference between the mussels enabling the mite to select its host.

Studies of host-parasite relationships often add much to the understanding of both groups of animals involved. Naturally great caution must be exercised and a careful analysis must be made of the biology of both host and parasite in order properly to evaluate the results. Certain general aspects of the biology of the water-mites parasitizing Unionidae have been pointed out by way of background. A detailed consideration of a recent study on the water-mites parasitic on the British species of *Anodonta* will be made here.

The material studied in this paper was collected by the junior author, who identified the mussels and recorded ecological data at each station. The mussels were determined in the field and the mites from each species were preserved and segregated as to host species. The senior author studied the mites and surveyed the literature.

Each locality is listed and described with its associated bivalve fauna. The number of mussels investigated for parasites and the total number of adult *Unionicola* found in each lot are given. Accurate correlation of nymphs and adults could not be made, so nymphs were neither identified nor listed. The mites occur chiefly between the inner and outer gill-plates and between the gill-plates and the foot; occasionally a few are found between the outer gill-plate and the mantle. They move fairly quickly over the epithelium of the host, particularly when disturbed.

(1) Nottingham Canal, near the Model Farm, Wollaton, Nottinghamshire.

The bottom of the canal is muddy and the water slowly moving. The two species of *Anodonta*, *A. cygnea* (L.) and *A. anatina* (L.), were taken together with *Unio tumidus* Philipsson, *U. pictorum* (L.) and *Dreissena polymorpha* (Pallas).

26 April 1952: 12 *A. cygnea* yielded 61 *U. ypsilophora* (Bonz).
16 *A. anatina* yielded 133 *U. intermedia* (Koenike).

10 May 1952: 9 *A. cygnea* yielded 66 *U. ypsilophora*.
14 *A. anatina* yielded 180 *U. intermedia*.

(2) Trent and Mersey Canal, near Shardlow, Derbyshire.

Water in the weed-filled canal is slowly flowing and variable in depth; the bottom is gravel. *U. tumidus*, *U. pictorum* and *Sphaerium rivicola*

(Lamarck) were present in addition to *A. anatina*. One dead shell of *A. cygnea* was seen.

19 July 1952 : 36 *A. anatina* yielded 16 *U. intermedia* and 2 *U. bonzi* (Claparède).

(3) Japanese Gardens, Newstead Abbey, Nottinghamshire.

A. cygnea was collected in a mud-bottomed pool, in which there were many water-lilies and *A. anatina*, in a three-foot wide outlet of the pool. The water is clear, one to three feet deep, and flows rapidly through the outlet. There were no other associated bivalves.

4 August 1952 : 4 *A. cygnea* yielded 47 *U. ypsilophora*.
4 *A. anatina* yielded 144 *U. intermedia*.

(4) Grantham Canal, near Gamston bridge, Gamston, Nottinghamshire.

The nearly still water of the canal is variable in depth. The bottom is clay, mud, or gravel and supports an abundant growth of *Spirogyra*. The *Anodonta* were found together with *U. pictorum* and *U. tumidus*.

9 August 1952 : 15 *A. cygnea* yielded 50 *U. ypsilophora* and 1 *U. intermedia*.
24 *A. anatina* yielded 27 *U. intermedia*.

(5) Lancaster and Kendal Canal, Carnforth, Lancashire.

The slowly moving water is three to eight feet deep and a great many lumps of carboniferous limestone lie on the muddy bottom. There were no other associated bivalves. *A. anatina* is rare.

8 September 1952 : 36 *A. cygnea* yielded 41 *U. ypsilophora*.
3 *A. anatina* were not parasitized.

(6) Gleaston Beck, near Urswick Tarn, Great Urswick, Lancashire.

The stream is clear, slowly moving, about twelve feet wide and one foot deep. The bottom is covered with a layer of red mud. There were no other associated bivalves.

11 September 1952 : 21 *A. cygnea* yielded 39 *U. ypsilophora*.

(7) Vicar's Water, Clipstone (Model Village), Nottinghamshire.

The pool, about 400 by 250 yards, is of clear slowly-moving water and supports an abundant population of *A. anatina* over most of the gravelly bottom. *A. cygnea* is limited to a patch of muddy bottom at one end. There were no other associated bivalves.

27 September 1952 : 2 *A. cygnea* yielded 20 *U. ypsilophora* and 3 *U. intermedia*.
21 *A. anatina* yielded 138 *U. intermedia*.

(8) Carburton Forge Dam, Carburton, Nottinghamshire.

The bottom is sandy. The steadily flowing greenish water is about three feet deep at the margins. The impoundment is about a mile long and 250 yards wide. *A. anatina* was abundant, but *A. cygnea* was represented by a single dead shell. There were no other associated bivalves.

25 October 1952 : 11 *A. anatina* yielded 74 *U. intermedia*.

(9) River Meden, Thoresby Park, Nottinghamshire.

The stream is four or five feet deep, with a muddy bottom, and fairly rapidly flowing. In addition to the two species of *Anodonta*, *U. pictorum* was present.

1 November 1952 : 10 *A. cygnea* yielded 32 *U. ypsilophora.*
A. anatina not examined for parasites.

Discussion.

Ten collections made at nine localities produced a total of 1,068 adult *Unionicola* from 238 specimens of *Anodonta.* Adult *U. ypsilophora* was limited to *A. cygnea.* The adult *U. intermedia* that normally parasitized *A. anatina* appeared in *A. cygnea* in two collections (4 & 7). These cases are easily accounted for as chance occurrences. The data indicate a clear-cut host specificity in the parasites of British *Anodonta.* 109 *A. cygnea* from seven localities yielded 356 adult *U. ypsilophora* and 4 adult *U. intermedia.* 129 *A. anatina* from six localities yielded 712 adult *U. intermedia* and 2 adult *U. bonzi.* At six of the localities the two *Anodonta* species occurred together. The two specimens of *U. bonzi* found in *A. anatina* in locality 2 may be a species normally found in one of the *Unio* species noted at this locality.

The two *Anodonta* parasites belong to different subgenera. *U. ypsilophora* (Bonz) of the subgenus *Unionicola* seems most closely related to *U. formosa* (*Dana & Whelpley*),[1] a species common in *Anodonta grandis* Say and *A. cataracta* Say in eastern North America. *U. intermedia* (Koenike) is placed in the subgenus *Pentatax* Viets and, like *U. ypsilophora*, its closest relative is a North American species, *U. wolcotti* (Piersig). *U. wolcotti* is rare and little is known of its host preference, but it has, on occasions, been taken together with *U. formosa.*

As mentioned there is no critical information on the host specificity of the *Unionicola.* Soar and Williamson (1927) give keys and descriptions of the British *Unionicola* ; nothing has been published on the British species since then. Viets's (1936) treatment of the German fauna includes all the species occurring in Britain and contains more critical detail. Neither of these works gives any indication of host specificity. Drawings of the two *Anodonta* parasites have been included to illustrate the great differences between the two species and provide more detailed and extensive illustration than is available in the above works.

It is hoped that this brief consideration of the water-mites parasitizing the British *Anodonta* will point out a few of the many interesting aspects of host-parasite relationships and possibly help to stimulate the more detailed investigations of the problem that are so badly needed.

EXPLANATION OF TEXT-FIGURE.

All figures except B drawn at the same magnification (× 33).

FIG. A.—Ventral aspect, female *Unionicola ypsilophora.*
FIG. B.—Terminal claw, leg three, female *U. ypsilophora* (× 180).
FIG. C.—Dorsal aspect, female *U. ypsilophora.*
FIG. D.—Dorsal aspect, male *U. ypsilophora.*
FIG. E.—Ventral aspect, male *U. ypsilophora.*
FIG. F.—Ventral aspect, female *U. intermedia.*
FIG. G.—Ventral aspect, male *U. intermedia.*

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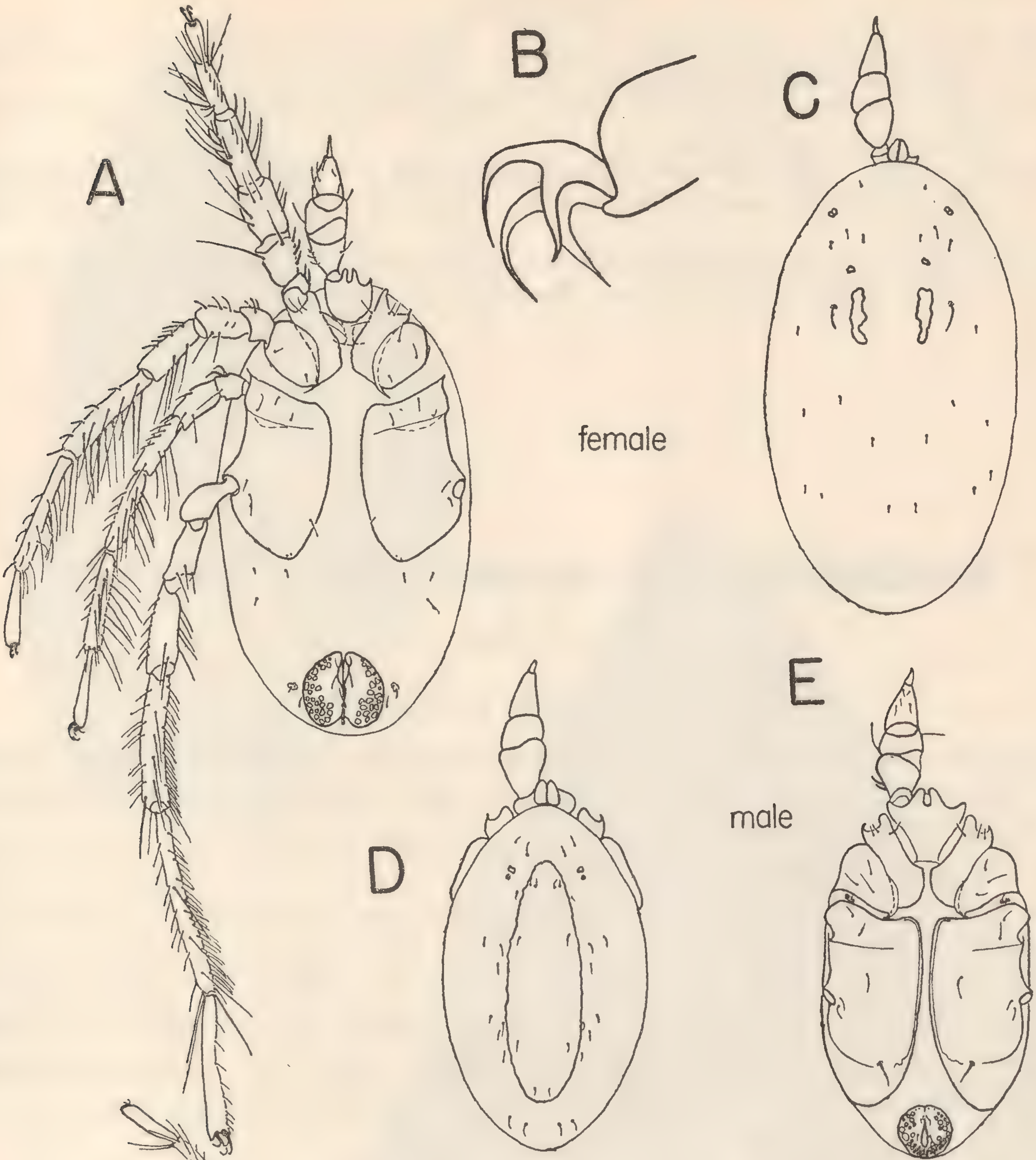
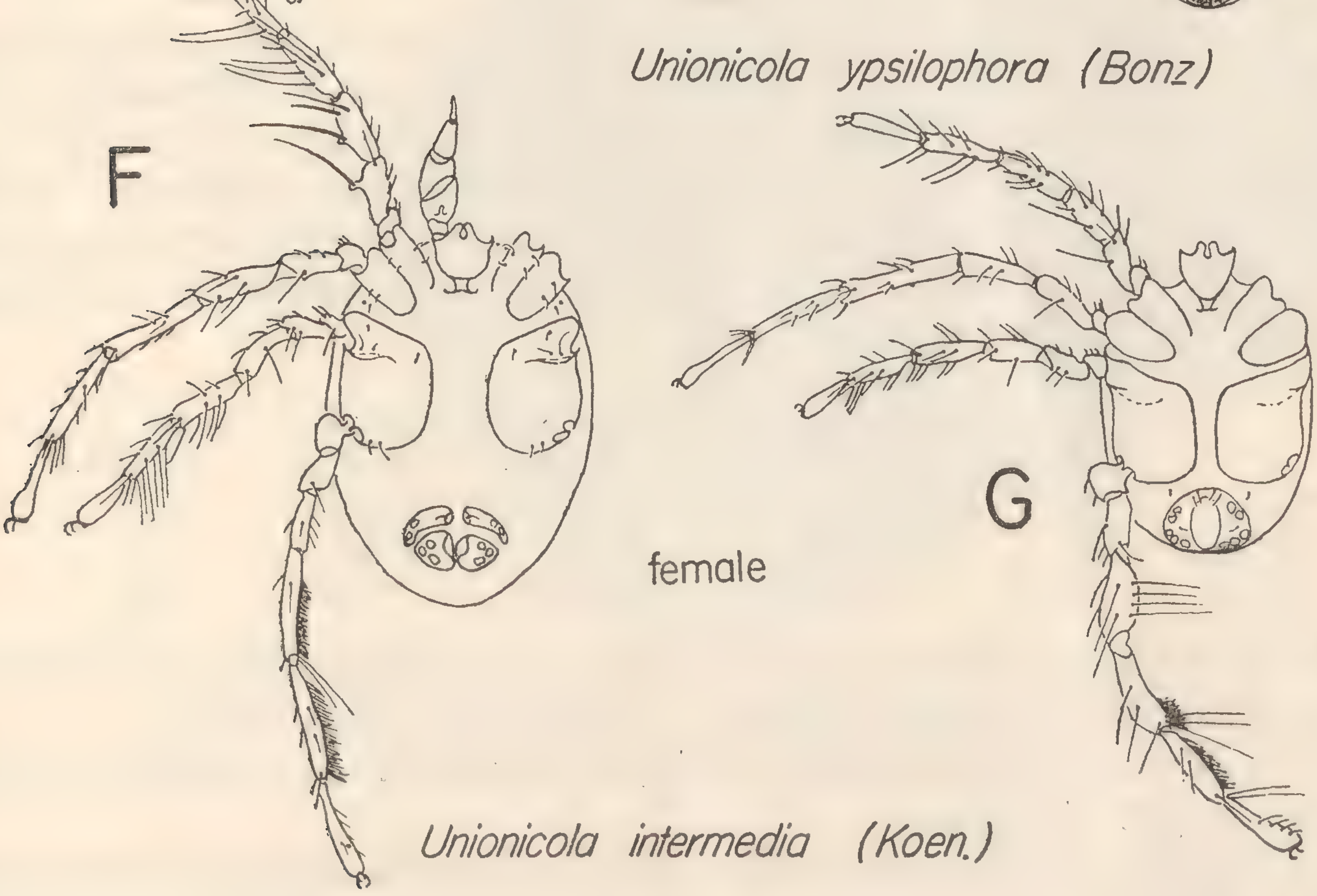
[1] *U. formosa* is one of at least two species that Wolcott (1899) erroneously referred to *U. ypsilophora.*



Unionicola ypsilophora (Bonz)



Unionicola intermedia (Koen.)

References.

Humes, A. G., and Jamnback, H. A., 1950. *Najadicola ingens* (Koenike), a water-mite parasitic in freshwater Clams. *Psyche* **57**, 77–87, 4 figs.

Soar, C. D., and Williamson, W., 1927. *The British Hydracarina.* Ray Society, **2**, 7 + 215 pp., 20 pls.

Viets, K., 1936. *Die Tierwelt Deutschlands und der angrenzenden Meeresteile.* Wassermilben oder Hydracarina. Teil 31–32, **7**, 10 + 574 pp., 652 figs., Jena.

Wolcott, R. H., 1899. On the North American species of the genus *Atax* (Fabr.) Bruz. *Trans. Amer. Micros. Soc.*, **20**, pp. 193–259, 6 pls.

SINISTRALITY IN *ACHATINA FULICA* BOWDICH

By T. Pain.

(*Read before the Society*, 15 *November* 1952.)

Although the occurrence of sinistral monsters amongst certain of the *Achatininae* is not uncommon and one species *Archachatina* (*Archachatina*) *bicarinata* (Bruguière) is normally so, sinistral specimens of the common *A.* (*Lissachatina*) *fulica* are extremely rare. As noted by Bequaert (1950, 76) only three or possibly four such specimens are known. The first was reported by Grateloupe (1840, 1841) from Madagascar. Smith's (1908) specimen (locality not mentioned) may also be Grateloupe's. Spence (1926) however records a specimen from Mauritius and in 1949 another was taken by Kodo on Pagen in the Marianas (Bequaert 1950, 76). Other references to sinistrality in *A. fulica* by Ancey (1906) and Dautzenberg (1911, 1914) were based on Grateloupe's record.

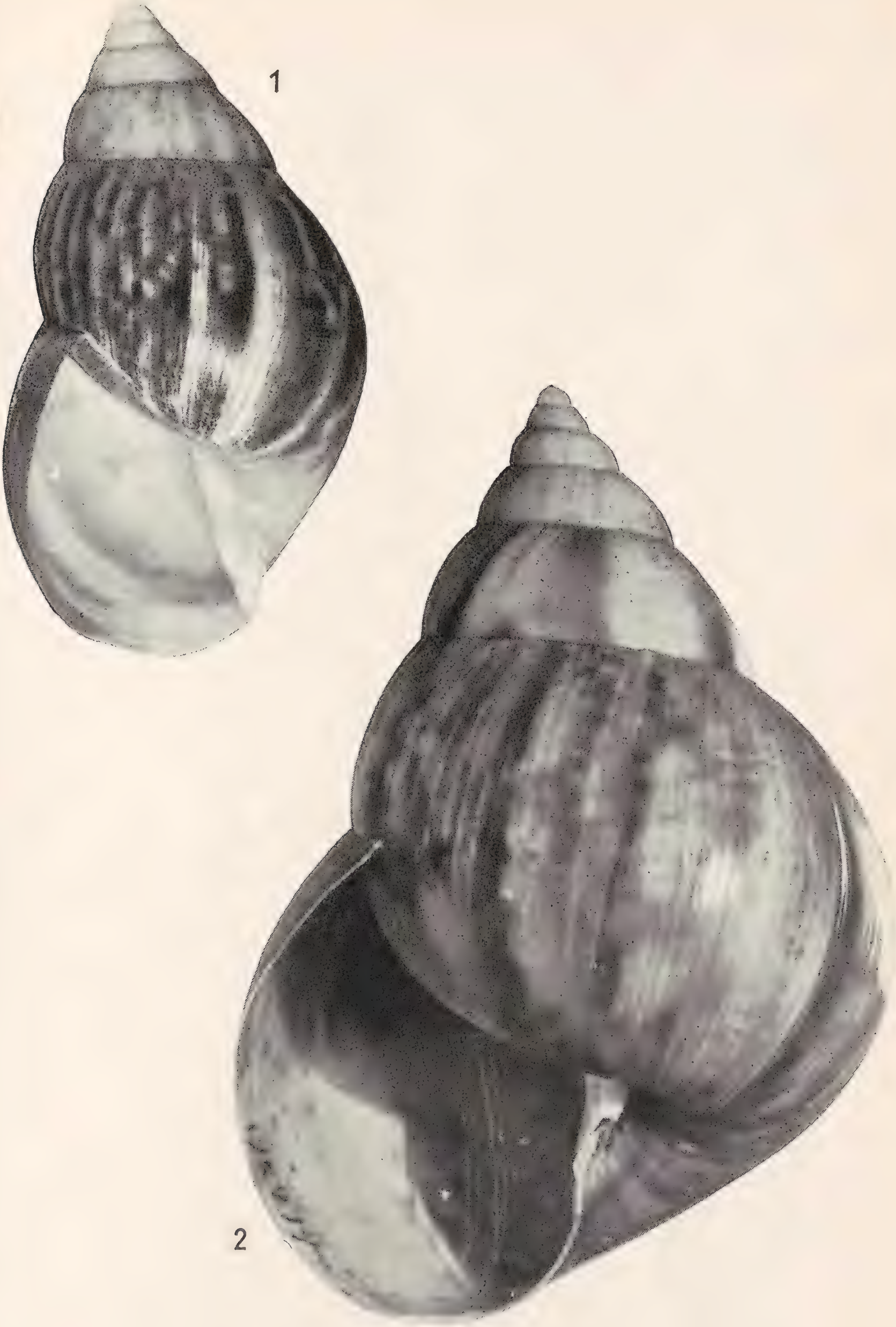
The occurrence therefore of two further sinistral *A. fulica* from Mauritius, obtained many years ago by the late Major M. Connolly, is of considerable interest. Of these one is now in the Museum of Comparative Zoology at Harvard College (M.C.Z.) the other in the possession of the author. Details of the dimensions of previously recorded specimens are unfortunately not given. Measurements in millimetres of specimens available to the writer are as follows—

	Height.	Greatest width.	Aperture. Height.	Aperture. Width.	Whorls.
No. 1.	73·5	53·8	40	27	7½
No. 2.	95·5	53·3	51	27	7½
No. 3.	62·5	35·5	34·8	17·3	6½

No. 1 is of characteristic shape and colour and differs only from normal dextral specimens in being sinistral ; ' Mauritius ' (Connolly).

No. 2 : an umbilicate sinistral shell ; Mauritius ? (Connolly) M.C.Z. No. 172214. (pl. 14, fig. 2).

No. 3 : sinistral shell collected in 1951 by Mr. Woodering Chamberlin on Tinian island in the Marianas ; it was the only one seen by the collector



Sinistral *Achatina fulica* Bowdich.

amongst the many thousands he examined. This specimen was collected alive and the animal preserved. (J. Bequaert in litt. 1952) (pl. 14, fig. 1). No. 1 is similar in appearance to this shell, but slightly larger.

Nos. 2 and 3, in the collection of the Museum of Comparative Zoology, Harvard College ; No. 1, in the possession of the author.

An interesting point regarding sinistral *A. fulica* is that they are always small compared with dextral shells with the same number of whorls.

Umbilicate and scalariform specimens are on the other hand of fairly common occurrence. Most of these monsters recorded in the past are from Madagascar, Mauritius, or the Seychelles, perhaps because the species has been longer established in these islands. The most recent records of sinistral shells however are both for the Marianas, a group of Pacific islands lying N.E. of the Philippines, to which it appears to have been introduced about 1939, presumably by the Japanese.

Van Benthem Jutting (1952) has suggested that an observation of Van Weel (1948) may in some measure account for the malformations and monstrosities which often occur in the species. " Snails which have ascended trees, walls, etc., do not climb back the way they have come, but let themselves drop down. Although a well-developed shell can withstand an enormous pressure, the sharp knock when reaching the ground often causes it to crack open."

The snail can of course repair its damaged shell, but a malformed specimen can result in this way, commencing usually at the original point of fracture. It seems reasonable to presume that many scalariform specimens with " shouldered " whorls have had their origin in this manner, since in most cases the shell up to the point of fracture is of normal form.

The present extensive distribution of *A. fulica* in Asia and the Pacific has been dealt with in detail by Bequaert (1950, 70) and Boettger (1951).

The author is deeply indebted to Dr. J. C. Bequaert for much additional information and advice, as well as for the excellent illustrations which accompany this note ; to Mr. L. Bilton for facilities to examine the G. C. Spence collection in Manchester Museum, and to Mr. W. J. Clench for permission to include details of specimens in the M.C.Z.

REFERENCES.

ANCEY, C. F., 1906. *Bull. Sci. France Belg.* **40,** p. 190.

BEQUAERT, J. C., 1950. Studies in the Achatininae. *Bull. Mus. Comp. Zool. Harvard* **105,** No. 1.

BOETTGER, C. R., 1951. *Abh. Braunschw. Wissensch. Gesellsch.* **3,** p. 10.

DAUTZENBERG, P., 1911. *J. Conchyl.* **58** (1910), p. 316.

DAUTZENBERG, P., 1914. *Bull. Soc. Zool. France* **39,** p. 57.

GRATELOUPE, J. P. S. de., 1840. *Actes Soc. Linn. Bordeaux* **11,** p. 164.

GRATELOUPE, J. P. S. de., 1841. *Ibid.*, p. 415, pl. 2, fig. 6.

JUTTING, W. S. S. van Benthem, 1952. *Treubia* **21,** p. 396.

SMITH, E. A., 1908. *Proc. Malac. Soc.* **8,** p. 1.

SPENCE, G. C., 1926. *J. Conchol.* **18,** p. 53.

WEEL, P. B. van, 1948. *Chronica Naturae* **104,** p. 336.

EXPLANATION OF PLATE 14.

Achatina fulica Bowdich, sinistral.

Figure 1 : Tinian Island, 62·5 × 35·5 mm.

Figure 2 : Mauritius, 95·5 × 53·3 mm.

THE FORMER OCCURRENCE OF BOTH *HELICELLA STRIATA* (MÜLLER) AND *H. GEYERI* (SOÓS) IN ENGLAND.

By B. W. Sparks.

(*Read before the Society*, 16 *May* 1953.)

Helicella (*Helicopsis*) *striata* (Müller) has long been known to occur in the Pleistocene of England. It was first recorded in 1917 (Kennard and Woodward, table facing p. 190) without locality, listed tentatively for the Cambridge district in 1920 (Kennard and Woodward in Appendix to Marr), and confirmed for a number of localities in Kent and the East Midlands in 1922 (Kennard and Woodward). During a recent investigation of some Pleistocene sections at Barrington, Cambridgeshire (Sparks, 1952), a number of strongly ribbed *Helicella* were found, but they differed in some respects from the specimens of *H. striata* from Trumpington and Grantchester, Cambridgeshire. On the other hand, they could not be distinguished from specimens of *Helicella* (*Xeroplexa*) *geyeri* (Soós) from Germany and the Baltic island of Gotland. As the latter species has often been confused with *H. striata*, it was thought that an attempt should be made to see whether *H. striata* and *H. geyeri* could be satisfactorily separated by features of the shell alone and to discover whether both species occurred in the English Pleistocene.

The two forms were first differentiated by Geyer (1917) in a paper in which he dealt with these strongly ribbed *Helicella* in Germany, but he regarded the smaller one as merely a minor form of *H. striata*. It was not until 1926 that Soós established the small form as a new and quite distinct species, mainly on anatomical grounds, and named it *Xerophila geyeri*. He included a description of the shell as well as of the anatomy, but, as he did not possess a good series of shells of *H. striata*, he was unfortunately unable to add a comparative description of the shells of the two species. Such a comparative description was not given in the original paper by Geyer (1917), but a few distinguishing characteristics were noted later (Geyer 1927). The principal differences were the small size of *H. geyeri* (diameter 5–6 mm. as compared with 7–9 mm. for *H. striata*); the nature of the umbilicus, which does not enlarge at the last whorl as it does in *H. striata*; and the shape of the last whorl of *H. geyeri*, which is at first somewhat compressed and angular, but becomes well rounded towards the aperture. Ehrmann (1933) also described both species and gave photographs of each.

A comparison of specimens of the two species, kindly supplied by Dr. Schlesch, from the Baltic islands of Öland and Gotland, from various places in Germany including the type locality of *H. geyeri* near Bothenheilingen in Thuringia, and of Geyer's f. *minor* from his own collection, revealed that there were significant differences between the shells of the two species. The correct determination of the Baltic specimens of both species was confirmed anatomically by Mr. Hugh Watson. The differences in the shells, which could be traced in the English Pleistocene specimens, may be summarized as follows. They are not always all present, and the identification of the shells should be based on a consideration of all their features.

(1) The shell of *H. geyeri* is usually smaller than that of *H. striata*, the largest British specimens of *H. geyeri* being alt. 5·5 mm. and diam. 7·5 mm., and of *H. striata* alt. 6·25 mm. and diam. 9 mm. Some of the British *H. geyeri* have a greater diameter than that quoted for the species by both Soós (1926) and Geyer (1927).

(2) The shell of *H. geyeri* is more compact and often slightly higher in proportion to its breadth.

(3) The protoconch, especially the first half whorl, is much smaller and more tightly coiled in *H. geyeri* than it is in *H. striata*. This characteristic appears to be constant and may be the best distinguishing feature.

(4) The remaining whorls of *H. geyeri* increase more slowly than in *H. striata* when seen from above, with the result that the aperture tends to be narrower, the breadth of the last whorl near the aperture being approximately one-fifth of the diameter of the shell and that of *H. striata* one quarter. Specimens of *H. geyeri* show about half a whorl more than specimens of *H. striata* of the same size.

(5) The upper part of the whorls of *H. geyeri* slope down more from the suture, so that their broadest part is usually slightly lower. This gives to *H. geyeri* a tendency towards a more conical shape.

(6) The periphery of immature shells of *H. geyeri* is usually more strongly angular, this angularity frequently extending to the first part of the last whorl in adult shells, a feature seldom found in *H. striata*.

(7) The umbilicus of fully grown *H. geyeri* is usually less open than that of *H. striata*, which expands characteristically at the last whorl.

(8) The radial sculpture of *H. geyeri* is coarser, the ribs, although irregular, being always strong especially over the periphery, where they are usually more curved than in typical *H. striata*.

(9) The colour banding of recent *H. geyeri* is nearly always broken into spots (as in typical *H. caperata* and *H. gigaxi*) and is seldom visible in fossils ; whereas in *H. striata* it is rather often well developed (as in *H. caperata* var. *ornata* and typical *H. virgata*) and is not infrequently visible in fossils.

(10) Recent specimens of *H. geyeri* also have the rib inside the lip weaker than it often is in *H. striata*, but this difference is seldom noticeable in Pleistocene specimens.

Through the kindness of Mr. C. P. Castell of the British Museum, Mr. A. G. Brighton of the Sedgwick Museum, Mr. R. V. Melville of the Geological Survey and Museum, Mr. A. E. Ellis, and Major J. P. T. Burchell, I have been able to examine shells recorded as *H. striata* from all the known British localities except Snodland, Kent. With the exception noted below, they are all apparently of Pleistocene age. The identifications have been checked by Mr. Hugh Watson, and the distribution of the two species is tabulated below.

KENT.	*H. striata.*	*H. geyeri.*	COLLECTION.
Loam no. 2, Newnham.	2	12	B. W. Sparks.
Loam no. 2, Newnham.	2	11	J. P. T. Burchell.
Loam no. 3, Newnham.	2	7	J. P. T. Burchell.
Doddington (= Newnham) Valley.	2	8	Kennard (B. M.).
Whornes Place Pit, Cuxton.	17	3	Kennard (B. M.).
Trechman's Pit, Cuxton.	6	—	Geol. Survey (61577).
Hilton's Pit, Halling.	—	2	Kennard (B. M.).
Halling.	1	8	Kennard (B. M.).
Halling.	—	5	A. E. Ellis.
Pit near Holly Hill, Halling.	2	17	Kennard (B. M.).
Batchelor's Pit, Halling.	1	26	Kennard (B. M.).
Batchelor's Pit, Halling.	1	5	Geol. Survey (61529 & 85036).
Bed 1, Aylesford.	—	2	Kennard (B. M.).
Subaerial loam, Brook Vale, Northfleet.	2	—	Kennard (B. M.).
Bed 2, Stone Castle Pit.	7	6	Kennard (B. M.).
Bed 4, Stone Castle Pit.	6	—	Kennard (B. M.).
Bed 4, Bean (= Stone Castle) Valley.	11	—	Burchell (B. M.).
Stone Castle Valley.	6	—	J. P. T. Burchell.
ESSEX.			
Forest Bed, Little Oakley.	—	8	Kennard (B. M.).
CAMBRIDGESHIRE.			
Cardo's Pit, Barrington.	—	2	B. W. Sparks.
Eastwood's Pit, Barrington.	—	51	B. W. Sparks.
Trumpington.	1	—	Sedgwick Museum.
Grantchester.	2	—	Sedgwick Museum.
HUNTINGDONSHIRE.			
Woodston.	2	—	Kennard (B. M.).

The shells from Woodston are flatter and more regularly striate than is normal for the species, but they are certainly not *H. geyeri.*

The shells from Little Oakley, Essex, are slightly different from the Barrington specimens. They are more depressed, the whorls enlarge a little less slowly, and, although they are worn, they appear to have been not quite so coarsely ribbed. In these features they are more like some recent specimens of *H. geyeri.* An unusual feature is the presence of traces of colour banding, which is more characteristic of *H. striata* than *H. geyeri.* Mr. Hugh Watson, after examining the specimens, has suggested to me that they may belong to a slightly different race of *H. geyeri* adapted to damper conditions. They are found in association with many freshwater species (Zeuner 1945, list on pp. 270–3) in a deposit which is probably considerably older than any of the others in which *H. geyeri* has been found.

These shells were found in a tube labelled "*radigueli* (Bourg.)" in the Kennard Collection at the British Museum. Kennard (1938, 1944, p. 157; Breuil, 1952, p. 201) regarded Bourguignat's species as identical with *Helicella crayfordensis*, described originally by Jackson (1914) and more fully described and figured by Kennard and Woodward (1915). The Little Oakley shells are certainly not *H. crayfordensis*, as the whorls enlarge too rapidly and are too few in number, the umbilicus is considerably too narrow and the aperture too large. Seeing that none is complete, it is impossible to say whether any of them possessed the flattening of the base of the peristome characteristic of *H. crayfordensis*. As Kennard had thus used Bourguignat's name for two different species, it was thought desirable to see which British species, if any, was the same as *Helix radigueli*. From the original description (Bourguignat 1869, p. 7 and pl. 1, figs. 38–43) it is obvious that *H. crayfordensis* Jackson is not a synonym of *Helix radigueli* Bourguignat for the following reasons : Bourguignat's description mentions a narrow umbilicus and a well rounded last whorl and aperture ; his figures show that the whorls enlarge more rapidly than in *H. crayfordensis* ; neither the description nor the figures indicate any flattening of the base of the peristome. On these grounds it may be concluded that the English Pleistocene species should be called *Helicella crayfordensis* Jackson. On the other hand, *H. radigueli* could be either *H. striata* or *H. geyeri*, both from the description and from the fact that Bourguignat referred it to the group of *Helix costulata* Ziegler in Pfeiffer, which is usually considered to be a synonym of *H. striata*. But it is impossible to decide the question on the basis of the description and figures alone. Unfortunately the original specimens of *H. radigueli*, for which Dr. Mermod kindly made a search, are not in Bourguignat's collection at Geneva and must be considered lost. Hence the species is indeterminate and its name should not be applied to any of the three extinct British Pleistocene *Helicellae*, which are *Helicella* (*Helicopsis*) *striata* (Müller), *Helicella* (*Xeroplexa*) *geyeri* (Soós) and *Helicella* (*Candidula*) *crayfordensis* Jackson.

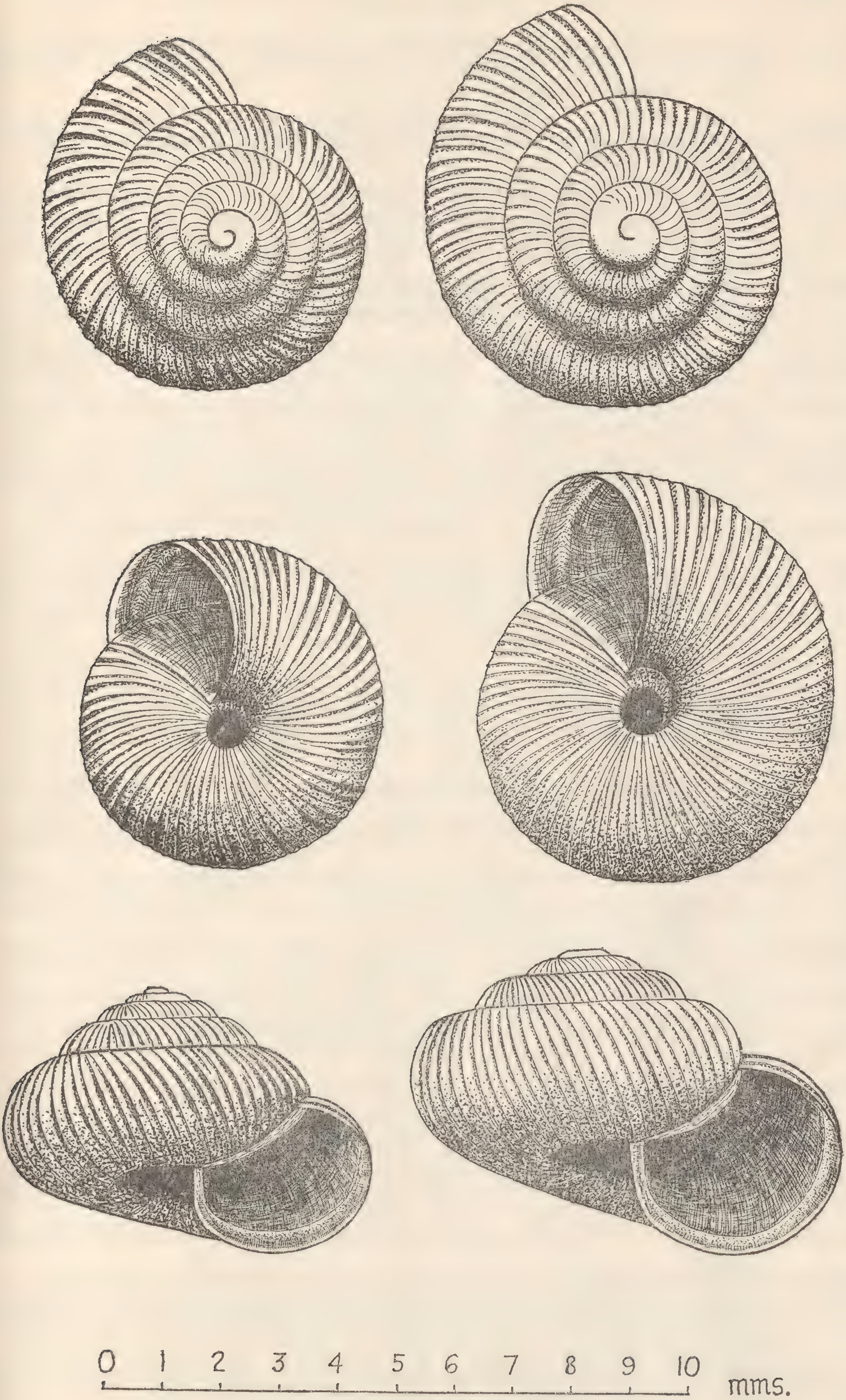
A further possibility, that *H. geyeri* is a synonym of *Helix costulata* Ziegler in Pfeiffer, had to be considered, as some specimens of *H. geyeri* from Metz in Bourguignat's collection are labelled "*Helix costulata* Ziegler". The description given by Pfeiffer (1828) is not sufficient for one to judge, but of the localities quoted for *H. costulata*, namely Austria and Hungary, particularly the Türkenschanze near Vienna, only the last has been quoted for *H. geyeri*. The record seems to have arisen in the following way : Sandberger (1870–5) referred to *H. costulata* var. *minor* from this locality, and Geyer (1917) recorded this as the small form of *H. striata*, which he later considered to be a synonym of *H. geyeri* (1927). Hesse (1934), quoting a letter from Edlauer, stated that the record was wrong, an opinion which can be confirmed, as specimens from the Türkenschanze, kindly sent by Dr. Edlauer, have all proved to be *H. striata*. Thus, *H. geyeri* is unlikely to be a synonym of *H. costulata*, as it is unknown in the localities quoted by Pfeiffer for that species. In any case, Sherborn (1925) has shown that the name *Helix costulata* Ziegler in Pfeiffer (1828) cannot be used as it is preoccupied by *Helix costulata* Renier, 1804.

At the present time both *H. striata* and *H. geyeri* live in relatively dry, calcareous places, mainly in central Europe, but extending northwards to the Baltic islands, *H. striata* having been found alive in Öland and *H. geyeri* in Gotland (Hubendick 1938 ; Schlesch 1951, 1952) where, however, it may have been introduced by man. Although the areas of distribution of the two species overlap in these regions and did so in England in the Pleistocene, the subgenera to which they belong occur mainly in widely separated areas: *Helicopsis* is essentially south-east European, whereas *Xeroplexa* is chiefly south-western and especially characteristic of the Iberian peninsula. Although *H. striata* has been recorded from Spain, Portugal and France, it has not been confirmed by dissection from any of those countries. According to Dr. Ortiz de Zárate, *Helicopsis* has not been confirmed from Spain and Portugal, all the specimens dissected of forms attributed thereto having proved to belong to *Candidula*, *Xeroplexa* and *Xerotricha.* Favre (1927) has shown that *H. geyeri* is found near Geneva, and Adams (1943) has discovered the same species in south Belgium. The records of *H. striata* and *H. striata* var. *costulata* from eastern France (Germain, 1930, p. 280) may be correct but require confirmation, especially as Bourguignat's collection contains specimens of *H. geyeri* from Metz. At present, therefore, *H. striata* has not been confirmed by dissection west of Germany, while *H. geyeri* has not been confirmed east of that country, the Vienna record being in all probability wrong as shown above. In the Pleistocene, *H. striata* and *H. geyeri* spread as far as England, where they lived, as they do to-day on the Continent, in calcareous districts. Most of the English fossil specimens have been found in chalk districts with the exceptions of the Woodston shells, which were found in the gravel of a river draining an area of Jurassic limestone, and those from Little Oakley.

North of the Thames the two species have not yet been found together. Trumpington, Grantchester and Woodston are all interglacial deposits, which, by comparison with beds recently dated by their pollen content (Hollingworth, Allison, and Godwin 1950), were almost certainly deposited in the middle of the last interglacial period. In these beds *H. striata* is associated with a large and varied fauna, characterized by a number of more southern species such as *Ena montana*, *Truncatellina cylindrica*, *Helicella crayfordensis*, *Azeca goodalli* and *Corbicula fluminalis.* On the other hand, *H. geyeri* has been found in an older interglacial deposit at Little Oakley, Essex, and associated with a hardy fauna, capable of standing cold conditions, at Barrington, Cambridgeshire (Sparks, 1952). The latter deposit is probably older than those which have yielded *H. striata.*

Yet, in Kent, the two species are apparently found in the same beds, as shown in the table above. In ten of the sets both species were found, in five *H. striata* alone and in three *H. geyeri* alone. Most of these beds are of Pleistocene age, but bed 4, Stone Castle Pit, is thought by Major Burchell (*in litt.*) to be almost certainly Holocene. Indeed, the associated fauna is of Holocene type and includes as the most common species *Pomatias elegans*, *Pupilla muscorum*, *Discus rotundatus*, *Oxychilus alliarius*, *Vitrea crystallina*, *Retinella pura* and *Retinella nitidula.* But, as this bed has immediately above it a floor of the Beaker period, it must be early Holocene. As far as is known at present *H. geyeri* did not survive the Pleistocene. Neither species has been found alive in Britain, although recent specimens of *H. geyeri* have been found in Belgium (Adams 1943, 1947).

I would like to express my gratitude to Mr. Hugh Watson in particular for the help he has given me in this investigation.



Helicella geyeri (Soós) left, and *H. striata* (Müller).

REFERENCES.

ADAMS, W., 1943. Notes sur les gastéropodes, XIII. Sur quelques espèces nouvelles ou rares pour la Belgique. *Bull. Mus. Roy. d'Hist. Nat. Belg.*, **19** (11), p. 6, figs. 1c and 2d.

ADAMS, W., 1947. Révision des mollusques de la Belgique. I, Mollusques terrestres et dulcicoles. *Mém. Mus. Roy. d'Hist. Nat. Belg.*, **106**, pp. 152–4, 234–5, 260, pl. 4, fig. 4.

BOURGUIGNAT, J. R., 1869. *Catalogue des mollusques terrestres et fluviatiles des environs de Paris à l'époque quaternaire.* Appendix to E. BELGRAND, *Histoire générale de Paris. La Seine. I, Le bassin parisien aux âges antéhistoriques.* Paris.

BREUIL, H., 1952. Glanes conchyliologiques en France (nord et sud-ouest) determinées par A. S. Kennard. *Congrès préhistorique de France*, XIIIe session, Paris, 1950, pp. 191–240.

EHRMANN, P., 1933. *Die Tierwelt Mitteleuropas*, **2** (*I*) ; *Mollusken* (*Weichtiere*). pp. 120–3, pl. 4, fig. 59, pl. 5, fig. 61. Leipzig.

FAVRE, J., 1927. Les mollusques post-glaciaires et actuels du bassin de Genève. *Mém. Soc. Phys. Hist. Nat. Genève*, **40**, fasc. 3, pp. 171–434.

GERMAIN, L., 1930. *Faune de France*, **21** ; *Mollusques terrestres et fluviatiles.* Paris.

GEYER, D., 1917. Die mollusken des schwäbischen Lösses in Vergangenheit und Gegenwart. *Jahres. Ver. vaterl. Naturk. Württemberg*, **73**, pp. 64–7.

GEYER, D., 1927. *Unsere Land- und Süsswasser-Mollusken.* Stuttgart. 3rd. ed., p. 76.

HESSE, P., 1934. Zur Anatomie und Systematik palaearktischer Stylommatophoren, Pt. 2. *Zoologica*, **33**, Heft 85, pp. 1–54.

HOLLINGWORTH, S. E., ALLISON, J., and GODWIN H., 1950. Interglacial deposits from the Histon road, Cambridge. *Quart. Journ. Geol. Soc.*, **105**, pp. 495–510.

HUBENDICK, B., 1948. On northern isolated occurrences of certain terrestrial molluscs in the Baltic area. *Journ. Conchyl.*, **88**, pp. 145–9.

JACKSON, J. W., 1914. Notes on the *Candidula* section of *Helicella*. *Journ. Conchol.*, **14**, pp. 193–9.

KENNARD, A. S., 1938 (in Report on the Swanscombe skull). *Journ. Roy. Anthropol. Inst.*, **68**, pp. 28–30.

KENNARD, A. S., 1944. The Crayford brickearths. *Proc. Geol. Assoc.*, **55**, pp. 121–169.

KENNARD, A. S., and WOODWARD, B. B., 1915. On *Helicella* (*Candidula*) *crayfordensis*, n. sp., from the Pleistocene deposits of south-eastern England. *Proc. Malac. Soc.*, **9**, pp. 270–1.

KENNARD, A. S. and WOODWARD, B. B., 1917. The post-Pliocene non-marine Mollusca of Ireland. *Proc. Geol. Assoc.*, **28**, pp. 108–90.

KENNARD, A. S., and WOODWARD, B. B., 1922. The post-Pliocene non-marine Mollusca of the east of England. *Proc. Geol. Assoc.*, **33**, pp. 104–142.

MARR, J. E., 1920. The Pleistocene deposits around Cambridge. *Quart. Journ. Geol. Soc.*, **75**, pp. 204–244.

PFEIFFER, C., 1828. *Naturgeschichte deutscher Land- und Süsswasser-Mollusken.* Pt. 3, p. 32. Weimar.

SANDBERGER, F., 1870–5. *Die Land- und Süsswasser-Conchylien der Vorwelt*, p. 808. Wiesbaden.

SCHLESCH, H., 1951. The north European *Helicella*. *Journ. Conchol.*, **23**, pp. 139–142.

SCHLESCH, H., 1952. Additional notes on northern *Helicella*. *Journ. Conchol.*, **23**, p. 273.

SHERBORN, C. D., 1925. *Index Animalium*, 1801–1850. Section 2, p. 1582. London.

SOÓS, L., 1926. Eine neue *Xerophila* aus Deutschland, *Xer. geyeri*, und anatomische Bermerkungen über *Xer. barcinonensis* (Bgt.). *Arch. für Molluskenkunde*, **58**, pp. 96–106.

SPARKS, B. W., 1952. Notes on some Pleistocene sections at Barrington, Cambridgeshire. *Geol. Mag.*, **89**, pp. 163–174.

ZEUNER, F. E., 1945. *The Pleistocene Period.* Ray Society, London.

NOTES ON THE MOLLUSCA OF THE GARVELLOCH ISLANDS.

By W. RUSSELL HUNTER, Department of Zoology, University of Glasgow.

I. INTRODUCTION.

PREVIOUS work on the ecology of the Hebrides has emphasized the effects of island-size and degree of isolation on the fauna (e.g. see Darling, 1947, and references therein). Most of the smaller more isolated islands lack calcareous rocks and provide as a result rather acid and consequently relatively infertile soils as an environment for plants and animals. In fact, the most fertile lands in the Hebrides are the narrow strips of *machair* where the Atlantic has piled up sand. The numerous tiny shells and shell-fragments of the sand have provided lime, and this, together with the mechanical properties of the sand itself, has resulted in light fertile soils. A few islands, however, have extensive outcrops of limestone. The island of Lismore, lying close inshore in Loch Linnhe, is well known, its lush vegetation and hard-water lochans with rich fauna being familiar to naturalists. Lying further offshore, the Garvelloch[1] Islands (or Isles of the Sea) have not been studied extensively. The present paper results from collections and observations made on the islands in the summer of 1949, during four days in early June and sixteen days in August and September. A small expedition, drawn mainly from Glasgow University, lived and worked on these otherwise uninhabited islands during the latter period. The conchological results recorded here fall into two sections : first, a list of the non-marine Mollusca found, with some comments on their ecology ; and second, a note on effects of the borings of *Hiatella* on the distribution of Mollusca and other fauna in the littoral zone. Before passing to these it is appropriate to outline the situation and geology of the islands.

The Garvelloch group lie where the Firth of Lorne opens out to the Atlantic Ocean, around lat. 56° 14′ N. and long. 5° 47′ W., over six miles from the mainland (less than two miles from other small islands). They are small, the whole group barely totalling one square mile in area. They are exposed to the ocean to the west and only occasionally visited by man. The two largest islands, Garbh Eileach (310 acres) and Eileach an Naoimh (200 acres), are each about a mile and a quarter long. Two other islands, A'Chuli and Dun Chonnuill, are both just under half a mile in length. Smaller islets range in size from those two hundred yards long which support considerable vegetation, down to mere rocks fifty feet across. In all, the group numbers over twenty islands, islets and skerries.

The rocks are almost all metamorphosed sediments of uncertain age and fall into the two main series summarized below (stratigraphy partly from Peach, Kynaston and Muff, 1909, and partly from the unpublished work of Mr. D. A. Muir and the present author).

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[1] The spelling GARVELLOCH has been adhered to. This conforms with the usage on some of the charts issued by the Admiralty Hydrographic Department and on all guides and maps issued by the Ministry of Works. The spelling GARVELLACH is used on other Admiralty charts and almost consistently by the Ordnance Survey and Geological Survey. Finally, local usage (including that of the proprietors and the present tenant) makes it GARVELLOCH. Both spellings are merely Anglicized phonetic renderings of the name of the largest island in the group : Garbh Eileach.

B. Quartzite series, the upper group of strata, consisting of pure quartzites alternating with beds of conglomerate (the uppermost of which has massive inclusions forming a " boulder-bed ") with some thin bands of sandy limestone interbedded.

A. Limestone series, the lower group of strata, consisting of creamy dolomitic limestones and a red calcareous grit, with some grey and black calcareous slaty beds.

They lie in one great recumbent fold towards the NNW, the core of the fold being the lowest and thickest limestone of series A. The sea has cut cliffs of up to 300 feet in height in this limestone core on the west and north-west sides of all the islands. The islands generally slope down to the south-east from the top of the western cliffs, outcrops of each rock bed traversing the islands from NNE to SSW. The highest ridges on each island, lying immediately above the cliffs, are of limestone, and drainage from these ridges produces alkaline soils on the lower slopes, even where the rocks beneath the soils are themselves non-calcareous. Water samples of such drainage on Garbh Eileach gave values of 36·3 mg. of calcium per litre and a *p*H value of 8·4. This may be contrasted with the waters of a hill loch in the adjacent island of Jura, with 2·16 mg. of calcium per litre, and *p*H 5·0. In general, the Garvelloch are not the brown or purple islands so typical of the Western Isles, but are unusually verdant. Landing on any of the group, one is immediately struck by the richness of the vegetation.

II. The Non-marine Mollusca.

Before considering any ecological aspects of the distribution, it is worth listing the non-marine Mollusca found on these visits to the islands. The specific names and systematic arrangement used in the list below are those adopted in the most recent census of the British non-marine Mollusca (Ellis, 1951). Mr. A. E. Ellis has kindly verified specimens of the species marked with an asterisk.

Lymnaea peregra (Müller).
Ancylus fluviatilis Müller.
**Cochlicopa lubrica* (Müller).
**Lauria cylindracea* (da Costa).
**Acanthinula lamellata* (Jeffreys).
**Clausilia bidentata* (Ström).
**Balea perversa* (L.).
**Arianta arbustorum* (L.).
**Helix hortensis* Müller.
**Helix nemoralis* L.
**Helix aspersa* Müller.
**Hygromia subrufescens* (Miller).
**Helicella virgata* (da Costa).
**Helicella itala* (L.).
**Cochlicella acuta* (Müller).
**Discus rotundatus* (Müller).
Arion hortensis Férussac.
Arion subfuscus (Draparnaud).
Arion ater (L.).

*_Vitrea crystallina_ (Müller).
*_Oxychilus cellarius_ (Müller).
*_Oxychilus alliarius_ (Miller).
*_Retinella nitidula_ (Draparnaud).
*_Zonitoides nitidus_ (Müller).
*_Vitrina pellucida_ (Müller).
Limax maximus L.
Limax marginatus Müller.
Agriolimax reticulatus (Müller).
Agriolimax laevis (Müller).

(_Pisidium_ sp.).

(_Littorina saxatilis_ (Olivi)).

Five species in the above list have not previously been found in vice-county 102, South Ebudes. Of these, _Acanthinula lamellata_, _Hygromia subrufescens_ and _Zonitoides nitidus_, have already been recorded for Census purposes (Ellis, 1952), and _Vitrina pellucida_ will be so recorded. _Agriolimax laevis_ cannot be included in the Census as no specimens were preserved for submission. These new records are not the most significant feature of the list, since vice-county records for South Ebudes include those from the large islands, Islay (154,000 acres) and Jura (90,000 acres), and from other islands of moderate size such as Colonsay (9,500 acres) and Scarba (3,700 acres). It is much more revealing to compare the molluscan fauna of the Garvelloch with those of Hebridean islands of similar size (i.e. of a few hundred acres in area). Unfortunately most previous surveys of non-marine Mollusca (e.g. Roebuck, 1890 ; Standen and Hardy, 1893 ; Annandale, 1922 ; Harrison, 1936, 1937 ; Carrick, 1939) have dealt mainly with the larger islands. An account comparable in some respects is that of Waterston and Taylor (1906) dealing with the rather special case of St. Kilda, their observations being made on the largest island in the group, Hirta (1,575 acres). However, the most suitable comparison can be made with the Eileanan Dubhan in vice-county 102 or the Treshnish Islands lying off Mull. Several snails listed by Boycott (1934) as calcicole occur on the Garvelloch and are absent from most of these other smaller islands. These include _Helicella virgata_, _H. itala_ and _Cochlicella acuta_, and less consistently _Helix hortensis_, _H. nemoralis_ and _H. aspersa_. The presence of all these snails in considerable numbers on the Garvelloch is undoubtedly due in part to the limestone rocks. Mr. A. E. Ellis placed the specimens of _Helicella itala_ submitted to him in the varieties _leucozona_ Moquin-Tandon and _hyalozonata_ Cockerell. It is of interest to note that if Scotland is considered as a whole, apart from its occurrence on such limestone islands as Lismore and the Garvelloch, _Cochlicella acuta_ is essentially a snail of the shell-sand _machair_. The factors which make the snail almost an " indicator species " for the soil-vegetation complex are both geographical and environmental : the western maritime exposure, the provision of calcium, and the relatively dry conditions provided by fast drainage. Not only do more species of snails occur on the Garvelloch than occur on more typical small peat-soil islands in the Hebrides, but the numbers of individual snails are higher. The larger species mentioned above are abundant on the limestone ridges, and numbers can be collected easily even in daylight. More ubiquitous species which can tolerate acid conditions are also more abundant. Some estimates made for *Clausilia bidentata*, based on rate of collection from similar habitats in heaps of loose stones, suggest that this snail is from eight to twelve times more abundant on Garbh Eileach than in some non-calcareous localities near Crinan on the Argyll mainland.

A few specialized habitats on Garbh Eileach and the other islands are worth mentioning. In all the little glens of the Garvelloch there is a rich growth of scrub forming long belts, densely packed and intergrown like man-made hedges, about eight feet high. The dominant bush is a willow, identified by Mr. B. W. Ribbons as a hybrid, *Salix atrocinerea* × *aurita*, but other species occur, including alder, hazel, birch, rowan and hawthorn. Brushwood on other Hebridean islands is on a much smaller scale and bog myrtle, *Myrica gale*, is the usual dominant plant. Few of the small exposed Hebrides (i.e. islands of a few hundred acres in area) have any semi-natural woodland. However, Garbh Eileach has a well-developed wood at its northern end, in which oak and ash are present as well as the species mentioned above. Both in the scrub and in the wood, *Balea perversa*, *Zonitoides nitidus* and *Limax marginatus* occur with other species. *Balea* does not seem to occur in the smallest Hebrides on the type of broken rock outcrops which support it in abundance in some parts of the Scottish mainland. Similarly, of the more ubiquitous slugs, *L. marginatus* tends to be most uncommon on small islands like the Eileanan Dubhan, although Carrick (1939) recorded it as common and widely distributed on Canna (2,600 acres), and Waterston and Taylor (1906) note "*Limax arborum*" as the most abundant slug on St. Kilda. Another interesting habitat is found on ledges of the western cliffs of all the islands of the Garvelloch, where abundant lime has been supplemented by the droppings of such birds as the Shag (*Phalacrocorax a. aristotelis*), forming shallow pockets of extremely rich soil, supporting very lush herbage. Among the plants found there, all of course tolerant of sea spray, are the following: *Sedum rosea*, *Armeria maritima*, *Urtica dioica*, *Sagina procumbens*, *Silene maritima*, *Taraxacum paludosum* and *Allium vineale*. In some of these cliff-ledge "gardens" there seems to be a greater volume of snails and shells than of soil. Of the snails which occur, *Oxychilus cellarius* is the most abundant, while *Cochlicopa lubrica*, *Lauria cylindracea*, *Hygromia subrufescens*, *Discus rotundatus*, *Oxychilus alliarius*, *Retinella nitidula* and *Vitrina pellucida* are present.

At first sight, it is odd that the list does not include any of the calcicole freshwater species. A few specimens of *Pisidium* were collected in a wet ditch on Garbh Eileach, but in error were placed in strong formalin and destroyed. Records from other islands suggest that they would have proved to be *P. casertanum* (Poli). The only two freshwater gastropods found on the Garvelloch were the two ubiquitous species, *Ancylus fluviatilis* and *Lymnaea peregra*. One of the reasons for this is undoubtedly the lack of permanent streams or real ponds, a feature typical of such small islands. But there is probably another factor: few of the British freshwater pulmonate snails can tolerate much salt in their environment, but *A. fluviatilis* and *L. peregra* are apparently insusceptible to increased salinity and often occur in estuarine conditions. Thus, in spite of the good conditions for snails offered by the calcareous water, only those two species have colonized the ditches of the spray-lashed islands of the Garvelloch group. Both snails make use of the lime in the water, having heavier thicker shells than individuals of the same species living in more acid water (e.g. on Jura). However, it is doubtful if the hard water of the Garvelloch would, on the mainland, support a more varied gastropod fauna. Boycott and Oldham (1936) noted, in their investigation of the calcareous lochs of the north-west of Scotland, that these isolated bodies of hard water supported none of the species which are considered calcicole farther south. They concluded that this obvious absence of species is due to historical reasons rather than to climate or the lack of lime. In relation to this problem the hard-water lochans of the Island of Lismore, supporting a vegetation unique among Scottish lochs (West, 1905, 1910), might repay further attention. Existing references to the Mollusca of these lochs in Lismore include those of Scott (1891), Standen and Hardy (1893), Roebuck (1916), and Boycott and Oldham (1936). The distribution of another gastropod on the Garvelloch must be a further result of the sea spray which reaches all parts of these " sub-oceanic " islands. Under some boulders in a gorge running through the western cliff on Garbh Eileach, *Littorina saxatilis* (Olivi) survives about sixty feet above high-water mark. Contact with salt water can only come when storms, driving the seas into this narrow cleft in the cliffs, send spray up to these boulders. A similar occurrence of another species, *Littorina littorea* (L.), occurring high above the sea on St. Kilda, has been recorded by Waterston and Taylor (1906). No young were found in these *L. saxatilis* populations on the Garvelloch and, in contrast to the other snails, their shells were relatively light and fragile. Darling (1947) quotes a suggestion by Elton that such invasion of the land by sublittoral species on small islands is related to the absence of competition.

III. The Effect of Borings of *Hiatella* on the Littoral Fauna.

The littoral fauna is also affected by the limestone rocks through a molluscan agency. The shores of the Garvelloch are very uniform, being the typical " steep-to ", smoothly rounded rocks which result from recent ice-sculpture. Rough surfaced and sharp-edged rocks are almost entirely absent : surfaces with an angle of slope of less than 70° are rare, vertical faces are general, and overhanging intertidal cliffs are common. Where these smoothed shore rocks are pure quartzites, the only abundant littoral animals are barnacles (mainly *Chthamalus stellatus* and *Balanus balanoides*, and to a lesser extent *B. crenatus*). The limpets *Patella vulgata* L. and *P. aspera* Lamarck occur. The limitations of this fauna are the consequence of three interacting factors : the steep slope of the rocks, the extreme exposure to wave-action, and their exceptionally smooth surfaces.

Over those parts of Garvelloch shores, however, where dolomitic limestones, calcareous grits, and certain fine-grained beds in the quartzite series are exposed, this third factor is altered. From about two feet above LWM, MST downwards, *Hiatella gallicana* (Lamarck) is found boring in such rocks, as it is also in softer calcareous mudstones (Hunter, 1949).

Where these latter rocks occur in British waters, the initial borings of *H. gallicana* or of Pholadidae result in a honeycombed rock which is further attacked by such organisms as the polychaete worms, *Polydora ciliata* and *Potamilla reniformis*, and the rock-boring sponge *Cliona celata.* The honeycombed rock may be completely destroyed by the activities of these latter organisms, and as a result a fresh surface is afforded for the attack of boring lamellibranchs. This cyclic destruction—honeycombing by bivalves followed by the boring of more minute organisms—can produce a distinct notch at the level of attack, and is essentially similar to the cyclic destruction of coral reefs described by Otter (1937). On the other hand, where the harder dolomites outcrop on the shores of the Garvelloch there is little action by any other organisms and consequently the honeycombing produced by *Hiatella* survives unaltered (after a certain density of boring has been reached) until *mechanical* marine erosion makes new surfaces available for further attack. There is evidence of a former stand of sea-level on the Garvelloch, the MSL of which lay 6·5 feet above Ordnance Datum. The dolomites being relatively resistant to sub-aerial erosion as well, a band of deserted borings corresponding to this old sea-level has been preserved and is very obvious. A preliminary account of this and other " fossil " borings at raised platforms of marine erosion has already been given (Hunter, 1951), and it is hoped to publish a detailed analysis of the occurrence of such fossil borings on several Scottish islands and in the Solway Firth. The relevant point is that those empty borings which correspond to the former sea-level 6·5 feet above O.D. lie within the present tidal range. The band has an upper limit about three feet below present high-water mark, and borings are densest in the two feet below this, becoming less frequent downwards until they are obscured by the band of burrows with living animals, which occurs just above low-water mark.

On these dolomites, then, the exceptionally smooth surfaces of other Garvelloch shores are replaced by thorough honeycombing. The littoral fauna is distinctly different. Some empty burrows are occupied by other bivalves, including *Paphia pullastra* (Montagu), *Modiolus modiolus* (L.), and young specimens of *Chlamys opercularis* (L.). Small non-boring individuals of *Hiatella*, retaining long fragile spines on their shell-valves, also occur. On the walls of the burrows many attached animals are found, some of which do not occur on the normal smooth rock surfaces. The tube-worm *Hydroides norvegica* is abundant, often encrusting the burrow walls so thickly as to occlude the boring. *Anomia ephippium* L. occurs, cemented to the walls of empty borings, up to four feet above LWM, MST. Of the barnacles, *Balanus balanoides* is still most common, but *B. crenatus* is to be found extending up to about a foot below MSL. *Chthamalus* is nearly absent.

Colonies of " dead man's fingers ", *Alcyonium digitatum*, of the sponge *Halichondria panicea* and of the sea-squirt *Botryllus schlosseri* encrust much of the honeycombed rock. In the debris behind the sponges and *Alcyonium* and in the borings sealed off by them, by barnacles and by tubeworms, certain other polychaetes occur, including abundant cirratulids and numerous scale-worms (*Harmathoë* spp.). *Calliostoma zizyphinum*

(Lamarck), which is abundant on the *Laminaria* of the sublittoral, occasionally appears in the areas of borings, while limpets are entirely absent from them as a result of the lack of flat grazing ground.

In summary, the occurrence of these deserted *Hiatella* burrows, conforming to the distribution of suitable rocks, creates a changed environment for shore animals from that offered by the glacially-smoothed rock surface. The main factor in this change is probably the provision of shelter. Some species, for example the cirratulid worms, are intertidal in normal habit but are not found usually on rocky shores. Other animals noted above, including *Balanus crenatus*, *Modiolus modiolus*, *Chlamys opercularis* and *Alcyonium*, are normally confined to the sublittoral on exposed shores, but find quiet water conditions in the honeycombed rock, and can extend their range upwards as a result of the protection afforded from intertidal wave-action. On the other hand, the similar upward extension of the range of *Anomia* is not likely to be due to protection from wave-action, as its thin shell, closely conforming to the rock surface, is able to resist any surf. The more probable explanation is that the borings provide a surface which does not dry out so thoroughly as the smooth native rock, *Anomia* being susceptible to desiccation. In this way, the honeycombed rock affords protection from exposure to the air as well as from exposure to wave-action. Such protection may result in exclusion of some species as well as permitting the extension of the range of others. The interrupted surface is responsible for the exclusion of limpets, and it is likely that the increased shelter from surf results in the absence of the barnacle *Chthamalus stellatus*, the feeding habits of which may require considerable turbulence (Crisp, 1950).

Thus, the dolomitic limestones of the Garvelloch islands, through their suitability for and preservation of the borings of *Hiatella*, again result in a change of fauna.

IV. ACKNOWLEDGMENTS.

I must acknowledge my indebtedness to my companions on these trips, to the proprietors of the Garvelloch Islands, and to the present tenant Ian S. MacKenzie, Esq., of Dunsmeorach. It is a pleasure again to record the continued encouragement of Professor C. M. Yonge, F.R.S., and the assistance received from Mr. A. E. Ellis, the Recorder of the Society, both in his verification of specimens and in his valuable comments in correspondence. Finally, I must thank my wife for help in the preparation of this paper.

V. REFERENCES.

ANNANDALE, N., 1922. The land and freshwater molluscs of some islands of the Inner Hebrides. *Scot. Nat.*, 19–27.

BOYCOTT, A. E., 1934. The habitats of Land Mollusca in Britain. *J. Ecol.* **22**, 1–38.

BOYCOTT, A. E., and OLDHAM, C., 1936. A conchological reconnaissance of the limestone in West Sutherland and Ross. *Scot. Nat.*, 47–52, 65–71.

CARRICK, R., 1939. " Mollusca " in The natural history of Canna and Sanday, Inner Hebrides : a report upon the Glasgow University Canna Expeditions, 1936 and 1937. *Proc. Roy. Phys. Soc. Edinb.* **23**, 1–71.

CRISP, D. J., 1950. Breeding and distribution of *Chthamalus stellatus*. *Nature* **166**, 311–312.

DARLING, F. Fraser, 1947. *Natural history in the Highlands and Islands.* London.

ELLIS, A. E., 1951. (Editor) Census of the distribution of British non-marine Mollusca. *J. Conchol.* **23,** 171–244.

ELLIS, A. E., 1952. Recorder's Report : Non-marine Mollusca. *J. Conchol.* **23,** 277.

HARRISON, G. Heslop, 1936. Land and freshwater Mollusca in the Hebrides : with an account of a species new to Scotland. *Scot. Nat.*, 81–85.

HARRISON, G. Heslop, 1937. The natural history of the island of Raasay and of the adjacent isles of South Rona, Scalpay, Longay and Fladday. II. The land and freshwater Mollusca. *Scot. Nat.*, 64–67.

HUNTER, W. Russell, 1949. The structure and behaviour of *Hiatella gallicana* (Lamarck) and *H. arctica* (L.), with special reference to the boring habit. *Proc. Roy. Soc. Edinb.* (B) **63,** 271–289.

HUNTER, W. Russell, 1951. Some observations on the borings of marine lamellibranchs and changes in sea-level. *Proc. Geol. Soc. Lond.* **107,** xiii–xv.

OTTER, G. W., 1937. Rock-destroying organisms in relation to coral reefs. *Sci. Rpts. Gt. Barrier Reef Exped., Brit. Mus.* (*Nat. Hist.*) **1,** 323–352.

PEACH, B. N., KYNASTON, H., and MUFF, H. B., 1909. The geology of the seaboard of Mid-Argyll. *Mem. Geol. Surv. Scot.* **36.**

ROEBUCK, W. D., 1890. Census of Scottish land and fresh-water Mollusca. *Proc. Roy. Phys. Soc. Edinb.* **10,** 437–503.

ROEBUCK, W. D., 1916. Main Argyll and its inland molluscan fauna. *Scot. Nat.*, 229–239.

SCOTT, T., 1891. The invertebrate fauna of the inland waters of Scotland, Part 2. *Ann. Rep. Fish. Bd. Scot.* **9,** part 3, 269–296.

STANDEN, R., and HARDY, J. R., 1893. The land and freshwater Mollusca of Oban and the Island of Lismore. *J. Conchol.* **7,** 266–274.

WATERSTON, J., and TAYLOR, J. W., 1906. Land and freshwater molluscs of St. Kilda. *Ann. Scot. Nat. Hist.*, 21–24.

WEST, G., 1905. A comparative study of the dominant phanerogamic and higher cryptogamic flora of aquatic habit in three lake areas of Scotland. *Proc. Roy. Soc. Edinb.* **25,** 967–1023.

WEST, G., 1910. An epitome of a comparative study of the dominant phanerogamic and higher cryptogamic flora of aquatic habit, in seven lake areas of Scotland. *Bathymetrical Survey of the Scottish Fresh-water Lochs* **1,** 156–260.

REVIEWS.

Australian Seashores. A Guide for the beach-lover, the naturalist, the shore fisherman, and the student. W. J. DAKIN, D.Sc. pp. xii, 372 ; 100 plates (3 in colour). Angus Robertson, London, 1953. 45*s.*

THE late Professor W. J. Dakin and his assistants, Miss Isobel Bennett and Miss Elizabeth Pope, have produced a book of similar importance to that by Ricketts and Calvin on the Pacific coast of America ; it is the result of over thirty years study of the Australian seashores, and during the last five years of this period the author and his assistants have collected and explored over two thousand miles of the eastern and south-eastern coasts, the Barrier Reef, and parts of Western Australia.

The first part of this attractive book contains eight chapters on various aspects of the sea and coastlines ; Plankton (happily termed " The Pastures of the Sea ") ; Luminescence ; Animal camouflage and colour on the seashore. Part 2 has very full chapters on all forms of marine life, including the zones of animal and plant life on the rocky shores of New South Wales.

Much could be said of the excellent photographic plates and diagrams that enrich these pages, but it is chapter 16, describing the Common

Molluscs of the Seashore and occupying nearly a quarter of the book (pp. 213–319), that must receive particular attention here. The chapter commences with a general account of the phylum as a whole, followed by details of the families which occur most frequently on the Australian shores. The author should be congratulated upon the number of living molluscs included in the 29 Mollusca plates, and few marine enthusiasts will fail to be attracted by the beautiful foamy float of the living *Janthina* (plate 63), the fully expanded *Umbraculum* (plate 67), or the wonderfully frondose mantle lobes of the Cowry (plate 64). It would have been a joy to see all these creatures in colour, but two of the three colour plates in the whole book are already given to the Mollusca, one consisting of attractive and brilliant Nudibranchs (plate 62) and the other (unfortunately reversed by the engraver) showing a variety of brightly coloured shells.

It is a pity, in an otherwise most useful book, that not a single authority is given for the scientific names used throughout the text and, while admitting that to quote an author each time a name is mentioned would add considerably to the bulk of the volume, there is no reason why the authors' names could not have been added to the scientific names in the index, at the cost of very little extra space. In a future edition (for which I am sure there will be an early demand) the inclusion of this important information, together with even a short bibliography, would make the book doubly useful to the " more serious student " mentioned in the preface.

G. L. Wilkins.

A Catalogue and Historical Account of the Sloane Shell Collection. Guy L. Wilkins. pp. 48 ; 12 half-tone plates (50 figures). Bulletin of the British Museum (Natural History), Historical Series, vol. 1, No. 1. London, May 1953. 16*s.*

A preliminary account of his work on the Sloane shells was given to the Society by Mr. Wilkins in his Presidential Address (*J. Conchol.* **23,** 247). The extended scope of this Catalogue is thus indicated by the author: " The surviving Sloane shells, recorded and described in detail in this paper, formed part of the nucleus of the shell collection in the British Museum at its inception in 1753. Many specimens date from the mid-Seventeenth Century and have personal associations with William Courten, Martin Lister, James Petiver, William Dampier, and numerous other contemporary author-naturalists and travellers. An attempt has been made to trace the history of the Sloane shell collection from the time of Courten and Lister to the present day—a period of nearly two hundred and seventy years. Many Sloane specimens were figured by Lister from 1685 to 1692, and a selection of these, together with the actual specimens and original Lister drawings, are reproduced in the accompanying plates."

Although it was assumed for many years that Sloane's shells were no longer recognizable, if they existed at all, Mr. Wilkins's painstaking researches have brought to light over four hundred of his original specimens. It is particularly felicitous that the publication of this fully annotated and well produced Catalogue should coincide with the bicentenary of Sloane's death and the foundation of the British Museum.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

722nd Meeting, held at the British Museum (Natural History), 18 April 1953.

The President in the chair.

Election of Member.

H. G. Poolman, 9 North Devon Road, Fishponds, Bristol.

Exhibits.

Rev. H. E. J. Biggs: *Lindholmiola lens* (Férussac), Mycenae, Greece, collected by Miss P. T. Biggs.

Mr. C. P. Castell: Recent and fossil opercula and fossil Cassidae from the British Museum collections.

Mr. H. F. Jones: Opercula of marine Gastropoda.

Mr. T. Pain: Opercula of non-marine Gastropoda.

Dr. H. E. Quick: *Helix aspersa* eaten by a fruit-rat, from Adelaide, South Australia, collected by B. C. Cotton.

Mr. G. L. Wilkins: *Cassis* and opercula from the British Museum collections.

723rd Meeting, held at the British Museum (Natural History), 16 May 1953.

The President in the chair.

Election of Member.

Vyvyan Arthur George Brown, Stenson, Woodland Way, Highcliffe, Christchurch, Hants.

Communication.

"The former occurrence of both *Helicella striata* (Müller) and *H. geyeri* (Soós) in England," by B. W. Sparks.

A letter from Mr. P. F. Bird, B.Sc., Curator of Zoology at the City Museum, Bristol, was read, stating that the collection of the Rev. Robert A. Marle (a life member of the Society, who died in 1939) has been presented to the Museum by his widow. The collection, which includes that of J. W. Williams, comprises chiefly British non-marine Mollusca.

Exhibits.

Mr. G. A. S. Barnacle: *Acavus* and marine Mollusca from Ceylon.

Mr. C. P. Castell: Recent and fossil *Lymnaea* from the British Museum collections.

Mr. A. E. Ellis: Recent and Pleistocene *Helicella geyeri* and *H. striata.*

Major R. J. Griffiths: Freshwater shells from the lake at Beckett Park, Swindon.

Mr. T. Pain: *Chilina* from South America; Pilidae selected to illustrate the gradation between dextral and ultra-dextral species.

Mr. G. W. Pitchford: British and foreign *Lymnaea*; "Illustrated Catalogue of Japanese Shells," by Dr. Tokubei Kuroda.

Mr. L. W. Stratton: British *Lymnaea.*

Mr. G. L. Wilkins: *Tridacna* from the British Museum collections.

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A SURVEY OF SOME ORKNEY BEACHES.

By R. Rendall.

(*Read before the Society*, 17 *October* 1953.)

For its small area Orkney has an extensive coastline, broken up into irregularly shaped islands (twenty-five of which are inhabited), and numerous small holms and skerries. Much consists of high cliff, especially on the west, and still more of flat rocky shores, many of which lie exposed to turbulent tideways and winter gales. There are also a number of great storm-beaches, and in certain districts large sandy bays, some confronting the open sea and others sheltered by headlands or long low points. A characteristic feature of certain exposed cliff-tops is what Wilson (1935) has called "high-level storm beaches", flagstone debris in crescentic mounds at the top of vertical cliffs, as, for example, at Sacquoy Head in Rousay, where the cliff reaches a height of 60 feet. There is thus a great variety of coast to be explored, and when it is also considered that Orkney lies at the junction of the western and eastern coasts of Scotland, and also is a sort of no-man's-land between the Atlantic Drift and Arctic waters, it will be realized that the islands have an interest all their own.

Naturalists of the last century who did research work in the north—notably Edward Forbes—largely concentrated upon the Shetland Islands and upon the Hebrides. Orkney, midway between, provides a connecting link. The predominating marine fauna of the islands seems to be associated with the North Atlantic Drift. Existing marine records, as, for example, Simpson (1910), have tended to link it with the North Sea area (even cartographers, until recently, placed it, for convenience, in the Moray Firth !) rather than with the western waters of Great Britain. It is only fair to add, however, that Simpson's records, and also those of Marshall (1893–1902), include dredging stations to the west as well as the east of the islands. The marine fauna of Orkney is perhaps best considered as held in balance between east and west, with a strong tendency toward western forms (R. Rendall, 1936).

This spring (1953) I have been able to fill in some gaps in a general survey of Orkney beaches, and have visited three of our northern islands : Stronsay, North Ronaldsay and Sanday.

STRONSAY.

Stronsay is divided into three large expanding peninsulae, meeting in the centre of the island in necks of land about half a mile to a mile broad. These peninsulae therefore enclose three large sheltered bays, formed of clean sand in which bivalves abound in variety. These are : Mill Bay, facing east ; Rothiesholm Bay, facing south ; and St. Catherine's Bay, facing west. The characteristic species include *Glycymeris glycymeris*, *Pecten maximus*, *Phacoides borealis*, *Cyprina islandica*, *Cardium echinatum*, *C. edule*, *C. crassum*, *Dosinia lupinus*, *Venus fasciata*, *Paphia pullastra*, *Donax vittatus*, *Tellina tenuis*, *Gari fervensis*, *Ensis ensis*, *E. siliqua*, *Mactra corallina*, *Spisula solida*, *S. subtruncata*, *Mya truncata* and *Lutraria lutraria*, besides such gastropods as *Colus gracilis*, *Buccinum undatum* and *Gibbula magus*.

The headlands and points provide little of interest, except Odin Ness, where a kind of storm-beach above rocks is usually heaped up with broken shell-drift, sometimes, it is said, to a depth of seven feet. When I visited it, I found that it consisted mostly of broken *Modiola* with a large percentage of *Glycymeris glycymeris*, *Buccinum undatum* and *Paphia pullastra*. *Trivia monacha* is abundant in such localities, but here there were few if any of the minute shells such as *Rissoa* found in similar drifts elsewhere. A local resident told me that there is a large mussel-bed in adjacent waters, and that this sometimes gets much broken up after storms of exceptional violence. Neill (1806) notes this shell-bed, and writes of " a very large bed of shells, which, I was assured, was thrown up by the sea in the course of a single stormy night twenty years ago ", continuing, " Upon examining the bed, I found that a great proportion of the shells consisted of single valves of *Arca glycymeris*." Those who know Orkney well will not be surprised at such sudden transformations of exposed beaches. During the hurricane of January, 1953, a whole sandy shore at Buttquoy Point, Birsay, was swept clean down to bedrock, and only now is regaining its normal appearance.

Some years ago, from a shell-collecting competition organized among Orkney schools, I obtained two specimens of *Tricla lignaria* found on the sands at Rothiesholm Bay. They were the first I had seen in Orkney, and as in subsequent years I did not come across them elsewhere, I was anxious to know if they were still to be found in Stronsay. After much searching I obtained several specimens (shells only), both at Rothiesholm (the original station) and also at St. Catherine's Bay. I have since been assured that they have been picked up at the Holm of Papa Westray, a small island further north, but this report is as yet unconfirmed. Rothiesholm was remarkable for the number of good clean examples of *Colis gracilis* thrown up by the tide, though these were generally only to be obtained at extreme low-water mark. *Mactra corallina* and *Donax vittatus* were also plentiful in this bay. In Mill Bay I found one or two fragments of *Zirfaea crispata*, valves of which I have also obtained on the shores skirting the String, a strong tideway situated eastward from Kirkwall Bay.

My visit coincided with the extreme spring ebbs of March. I was therefore able to examine the beaches under favourable conditions. Though not able to do any intensive digging for live specimens (preferring rather to obtain a general picture of the shores), I saw much of interest, especially at St. Catherine's Bay. Here, at extreme low-water mark, the following molluscs were taken alive, being secured by the use of a large carving knife thrust suddenly into the sand where active spout-holes indicated the presence of a live animal, and made to press the shell firmly against the side of its retreat : with the other hand one could then scoop out the animal by rapid digging. *Ensis ensis*, *E. siliqua* (these inhabited distinct areas of the bay at about the same tide-line), *Lutraria lutraria* and *Cyprina islandica*. All these are eaten by the islanders.

The bay is very extensive, and a large area of sand is exposed both in breadth and depth from the shore. The *Cyprina islandica* were of exceptional size, the average being about 4½ inches in breadth, but worn single valves of much larger size were not uncommon. Specimens still larger are said to be taken on the small uninhabited island of Linga Holm at the mouth of the bay. These large examples were taken alive at low-water mark toward the middle of the bay. Walking slowly along the tideline shoreward, I collected numerous fresh specimens (shells only), and was impressed by the regular and graduated decline in size as one approached the sides of the bay, until at last I was picking up complete specimens scarcely the size of a shilling. At the south side of the sands *Cyprina islandica* was closely associated with *Dosinia lupinus*, which also occurred there in considerable numbers.

I have visited most of our Orkney shores, and can say without hesitation that these three Stronsay bays are undoubtedly the best collecting grounds in the islands for bivalves, especially Rothiesholm Bay and St. Catherine's Bay. Incidentally these two, like the near-by Bay of Backaskaill in the island of Sanday (a bay of similar character and fauna), face what may be termed the inner waters of the Orkneys, which, although swept by strong tideways, are not exposed to the unrelenting fierceness of the open sea.

NORTH RONALDSAY.

North Ronaldsay, the most northerly of the Orkney Isles, is only about three miles long and little over one mile wide. It is girdled by a sea-wall, outside which some two thousand small native sheep subsist on what the shore can provide, littoral seaweeds, fronds of *Laminaria* (and stems !) cast up by the tide, and the sparse thin vegetation between the shore-stones. The shoreline is largely a storm-beach formed of tumbled slabs and boulders pitched at a steep angle from the rocks below up to the sea-wall, but is broken here and there by gravelly patches and on the south and east by sandy bays, on which, however, scarcely a single shell is to be found. The numerous rock-pools make it a paradise for algologists. Incidentally, North Ronaldsay figures prominently in Traill's monograph (1890). There is also an abundant variety of sea-anemones and epizoic Hydroids in these pools.

Along the upper part of the beach, which in places was literally " paved " with flat stones slithered up by storms, I noted (especially on certain stretches on the east and north) many boulder stones riddled by *Hiatella arctica*. These are not infrequent on other Orkney shores, but I never saw them so thickly strewn as here. From a single boulder I recovered fifteen complete but weather-worn specimens, the largest measuring 22 mm. in length. The phenomenon was so marked that I cast about in my mind how to account for it. Was there a dense colony established in the vicinity ? Or was it that the extreme exposure of the island to unmitigated storm had cast up material that in other parts of Orkney would have remained on the sea-bed ? It was only afterwards that I realized from a sea-chart that opposite the two areas which I had noted lay extensive rocky shoals, one an outcrop from the sea called Seal Skerry, and the other a large shoal-reef only about four fathoms under the surface at low water. It would be interesting to know if such conditions favoured the colonization of *Hiatella*.

One afternoon I explored the rough western shore, composed entirely of great rocky reefs difficult to clamber over. When I reached the lower littoral zone I found this almost completely encrusted with *Balanus balanoides*, more so than I have seen elsewhere. With these were associated dense colonies of *Mytilus edulis*, studded here and there with *Actinia equina*, an arresting example of commensalism. Moreover, the grouping was not without aesthetic beauty, the intense blue and blue-black of the mussels contrasting with the conspicuous whiteness of the barnacles and the rich crimson of the sea-anemones; and below, the vivid emeralds and dark greens of algae added a final attraction to the picture.

The mussels were mostly ranked on the lower shelf of long eroded horizontal cavities in the vertical face of the rock, facing seaward. Those shells impinging on the under side of these overhanging " shelves " were much darker in colour, while here and there I saw single specimens with hues of golden brown. The barnacles were so densely packed together that most had elongated vertical sides. Some of the mussels were entirely encrusted and buried in the thick masses of *Balanus*.

I observed that when a wave broke on an adjacent rock its cataract of spent water ran down these rocky channels and crevices inhabited by the mussels—there was a slight inward incline to the shelves of rock. This appears to provide a natural source of food supply. It was most noticeable also that common littoral molluscs like *Nucella lapillus*, *Gibbula cineraria* and *Littorina littorea* avoided the open exposed surfaces of rock, and were only to be found by poking into crevices. *Nucella* seemed to favour the underside of those overhanging shelves where the mussels were so dense on the upper. On such " roofs " they would probably be less exposed to the swirl of the waves. A varied natural economy of need thus distributes different genera, even in the same zone. I detected several individuals of *Nucella* which occupied small private caves of their own, out of which they could only be extracted with difficulty. These were mostly darker in colour and showed clean surface striation. This adaptation of habit to severe local conditions is noteworthy.

I carefully examined the whole shoreline for shell-drift, but except for pockets of broken pulverized fragments found none. Once only, on the east side, at the head of a sandy spit between rocks, called Hastie Geo, did I obtain about a quarter of a pint of tide-swirled drift, in which later I was able to pick out examples of *Retusa retusa*, *R. alba*, *Cingula semicostata* and other not uncommon small species.

It is rather difficult to know whether winter storms cast up good molluscan material in this island. Experience from similar shores in other parts of Orkney leads me to believe that they may. Our Orkney shores alter quickly under varying conditions, and what now seems barren of specimens may all at once become a treasure trove : the converse is also true, and unfortunately with regard to these remoter islands one cannot always be on the spot and take that necessary immediate advantage of suddenly occurring favourable conditions.

SANDAY.

Backaskaill Bay in the large island of Sanday usually has excellent shell-drift, and I broke my return journey to Kirkwall there in order to obtain a fresh supply for examination at home. It appears rich in species. Also, among debris thrown up by a recent gale, I found a single example of *Tethys punctata* measuring 63 mm. in length, intact with internal shield. On 22 April this year I found living specimens in rock-pools high up the shore at Buttquoy Point, Birsay, on the mainland of Orkney. I have already referred to the large bivalve population of Backaskaill Bay.

Names of species follow those given by Winckworth (1932).

REFERENCES.

MARSHALL, J. T., 1893–1902. Additions to "British Conchology". *J. Conchol.*, **7–9** (*passim*).

NEILL, Patrick, 1806. *A Tour through some of the Islands of Orkney and Shetland.*

RENDALL, R., 1936. *Simnia patula* (Pennant) in Orkney. *J. Conchol.*, **20,** 283–5.

SIMPSON, J., 1910. Notes on some rare Mollusca from the North Sea and Shetland–Faeroe Channel. *J. Conchol.*, **13,** 109–115.

TRAILL, G. W., 1890. The Marine Algae of the Orkney Islands. *Trans. Bot. Soc. Edinburgh.*

WILSON, G. V., 1935. *The Geology of the Orkneys.* H.M. Stationery Office, Edinburgh.

WINCKWORTH, R., 1932. The British Marine Mollusca. *J. Conchol.*, **19,** 211–252.

***Volvulus* Oken.**—With the intention of suppressing this name by making it a later synonym of *Clausilia* Draparnaud, I selected *V. perversus* Oken as the type species of the genus (*J. Conchol.* **23**, 51). I had overlooked a previous selection of type, to which Dr. Horace B. Baker, of the University of Pennsylvania, has kindly drawn my attention. In 1928 Pilsbry (*Nautilus*, **41**, 108), with the same intention, designated *V. bidens* Oken as the type species of *Volvulus*. If, however, Kennard and Woodward (*Synonymy of British non-marine Mollusca*, 278) were correct in identifying *V. bidens* Oken with *Turbo laminatus* Montagu, then Pilsbry's selection would seem to have been misconceived, as *Volvulus* Oken, 1815, unfortunately has priority over the well known name *Marpessa* Gray, 1821, and also over *Cochlodina* Férussac, 1821, which some authors have employed for this genus.

A. E. ELLIS.

Copenhagen Decisions on Zoological Nomenclature: additions to, and modifications of, the *Règles internationales de la Nomenclature zoologique*, approved and adopted by the 14th International Congress of Zoology, Copenhagen, August, 1953. Edited by Francis Hemming, C.M.G., C.B.E. Sold at the Offices of the International Trust for Zoological Nomenclature, 41 Queen's Gate, London, S.W. 7. Issued 31 December 1953. Price 5*s.* (postage 6½*d.*). "An indispensable work of reference to all systematists."

A NOTE ON THE DISTRIBUTION OF *ANODONTA CYGNEA* (L.), HAVING REGARD TO THE DIFFERENCES IN SEX AND GILL-STRUCTURE. IV.

By H. H. Bloomer.

(*Read before the Society*, 17 *October* 1953.)

In my last paper (*J. Conchol.* **23,** 296) I stated that all the individuals in the sample of *A. cygnea* from the beck, Urswick Tarn, had the outer gills more or less filled with glochidia, but that the smears of the gonads gave insufficient evidence of their sex-condition, therefore it seemed desirable to continue the research and Mr. G. W. Pitchford endeavoured to arrange for another sample before the next spawning season. All efforts to obtain one at the appropriate time proved unavailing and it was not until September 1952 that he secured a sample. It consisted of 14 individuals, of which eleven had glochidia in their outer gills (in two of the remaining three the gonads were unripened, whilst in the third one only a small portion had matured : the outer gills were of a marsupial nature) ; the smears revealed a scarcity of both male and female products, more especially the former, similar to those of the 1951 sample, consequently it appears safe to assume that the comparative scarcity of sexual products in the smears taken after spawning time indicates the usual condition in the beck mussels and in this respect differs from the examples from the River Frome, Dorset (*Proc. Malac. Soc.* **27,** 62).

On 29 June 1953 Mr. Pitchford was able to send a further sample of 13 individuals. Twelve of them were examined between then and 14 July and one was kept as an experiment. Nine of the twelve had the outer gills of a marsupial character, but there was uncertainty concerning those of the remaining three, the structure of which, owing to the bad condition, through delay in examination, could not be definitely ascertained. The smears of the gonads of all the mussels contained ova in varying quantities, with a number of a mature or nearly mature nature. The male products were either very scanty or absent and when present only disclosed the early stages of renewed development : this state was surprising in view of the near approach of the normal spawning season of the species, although that event would appear to happen there later in the year than in the waters in the south of England (*Proc. Malac. Soc.* **23,** 286–297).

The mussel, 107 mm., from the beck received on 13 September 1952 was isolated, kept in a round earthenware vessel, 36 cm. in diameter and 16 cm. deep, fed on crushed oats, and examined on 31 August 1953. The outer gills were of a marsupial nature but had no embryos in them : the smears of the gonads revealed a moderate quantity of ova in different stages of development but there was no evidence of maleness.[1]

The individual, 102 mm., received from the beck on 3 July 1953, kept isolated in a round earthenware vessel and fed on crushed oats the same as previously, was examined on 3 September 1953. Both of the outer gills were expanded and were partly filled with eggs (recently passed to them and not having the glochidial shell formed), the gill on the right more than the one on the left side : smears of the gonads showed only a few relict ova : there were no male products.

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[1] In these long period experiments it seems that the longer the animal is kept the thinner it becomes and the more the digestive gland is discoloured. This condition is probably due to the absence of an essential property either in the food or through the animal being deprived of mud on the bottom of the vessel.

To summarize the samples for the three years 1951–1953, 37 individuals were examined and all were found to possess ova in the smears of the gonads : of the 25 examined after the spawning season, 22 had embryos in the outer gills, and of the 12 examined before the spawning season, 9 had unmistakably marsupial outer gills, there being uncertainty about the remaining three.

The puzzling feature has been the scantiness or absence of male products both before and after the normal spawning season, and this factor makes it difficult to ascertain the occurrence of hermaphroditism—however, smears have their limitation and only explore a part of the gonads—but it was seen to occur in some cases and probably is more common than at present envisaged.

That so many of the individuals had larvae in the outer gills after the spawning season, and a large proportion when not gravid had marsupial outer gills, showed that most of them were capable of functioning as females. Then no males at present having been found in the beck suggests that they may not exist there ; if they do, they must be rare. The conclusion reached is that fertilization in a great measure if not altogether depends upon the prevalence of hermaphroditism.

Regarding the experiment with the mussel kept in isolation from July to September 1953, which when examined had the outer gills partly filled with eggs, it should be borne in mind that this individual was one of the sample which upon examination showed the male portions of the gonads to be undeveloped, so that the animal experimented with was in all probability in the same condition at the beginning of the test ; the assumption therefore is made that this is an instance of self-fertilization [1] similar to that obtained in the experiments with the mussels from the River Frome, Dorset (*Proc. Malac. Soc.* **24,** 113–121, **25,** 192–9).

In the experiments with the River Frome mussels each animal was isolated and kept over the latter portion of the time of the ripening of the gonads, the passage of the eggs to the outer gills, and until the glochidial shell was partly formed. Thus it was claimed that the larvae had been produced by self-fertilization—no evidence of the storage of spermatozoa has been found (*Proc. Malac. Soc.* **25,** 193)—hence the only available spermatozoa were those produced by the animal itself about the same time as the ova.

The theory of or belief in self-fertilization occurring in *Anodonta* is not at all new, and if not stated may be inferred from the writings of some of the early investigators (*Proc. Malac. Soc.* **21,** 304–321), yet none was more emphatic than Henri Drouet who said with some semblance of truth over a hundred years ago [1] " Je traiterai, plus tard, de la production de ces Mollusques [*Anodonta*]. Aujourd'hui, je me contenterai de rappeler, en passant, qu'ils sont hermaphrodites (leur hermaphrodisme est suffisant, c'est-à-dire qu'un individu seul se féconde lui-même), ovovivipares, et que le sexe femelle est seul apparent ".

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[1] The experiment needs to be repeated to confirm the result given, if possible, nearer the beck. To transport the mussels in full vitality is not easy during the hot summer months ; shells with a gape should be avoided.

On 7 September 1953 Mr. Pitchford sent a sample of 16 *A. cygnea* gathered from the Lancaster and Kendal canal at Carnforth, Lancashire. The canal is from three to eight feet deep : the bottom is strewn with pieces of carboniferous limestone and in between are patches of gravel and mud : the water is clear and contains an abundance of aquatic vegetation, much molluscan life and colonies of the freshwater sponge *Spongilla lacustris* : *A. anatina* occurs sparingly : the fish are pike, tench, roach, perch and stickleback. The shells range in size from 81 to 150 and average 103 mm., are thin and vary in shape from the typical form to var. *zellensis* Gmelin. All the individuals carried larvae in the outer gills, ranging from some that had just entered the gills to others with the glochidial shell partly formed. In the smears of the gonads all had relict ova of various sizes, all but one possessed male products, of which 14 had sperm-morulae in different stages of development and 13 had spermatozoa, so that all but one of the 16 individuals were hermaphrodites.

The distinctive feature of male products in the smears is in marked contrast to that elicited from the Urswick beck samples and is more remindful of what occurs much farther south. It is also very interesting to find that hermaphroditism is quite common so far north. Furthermore, it would be instructive to see the result of an experiment with the canal mussels, keeping each individual in isolation over the spawning season.

I wish again to express my gratitude to Mr. G. W. Pitchford for his most valuable assistance in enabling me to extend the research so far north, for without his aid it could not have been accomplished.

Correction : *J. Conchol.* **23**, 295, line 13, delete " of other sections of the " and substitute " the Nottingham ".

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[1] *Études sur les Najades de la France* (Études sur les Anodontes de l'Aube), 1852, trois. art., p. 7.

NOTES ON A COLLECTION OF NON-MARINE MOLLUSCA FROM SEMI-ARID AREAS OF EAST AFRICA.

By T. Pain.

(*Read before the Society*, 17 *November* 1953.)

Records of land and fresh-water Mollusca from this arid region are very few and far between, which gives a greatly added interest to a small but accurately localized collection made by Mr. C. F. Hemming, of the Desert Locust Survey, during the years 1950–2, which forms the subject of this note. Ten species of land and fresh-water Mollusca were obtained by Mr. Hemming, who describes the country as a region of high plateau with an arid climate, subject to two periods of short seasonal rain, accompanying the N.E. and S.E. monsoons. During the dry season when Mr. Hemming's collection was made only dead shells could be seen. A visit during or immediately after the rains would be necessary to obtain living examples.

I am much indebted to Dr. J. C. Bequaert for help and advice in the identification of the land shells, to Mr. A. Blok for invaluable assistance in checking references, and to Mr. Hemming for details of the localities and their geographical position.

ACHATINIDAE

Achatina Lamarck, 1799

Achatina (*Lissachatina*) *fulica hamillei* Petit.

Achatina hamillei Petit, 1859. *J. Conchyl.* **7,** 384, pl. 13, fig. 3.

Achatina (*Lissachatina*) *fulica hamillei* Bequaert, 1950. Studies in the Achatinidae. *Bull. Mus. Comp. Zool. Harvard* **105,** No. 1, 79, numerous figs.

Northern Province, Kenya Colony: Garessa (0° 28′ S, 39° 37′ E), Dec. 1950; El Wak (2° 47′ N, 40° 55′ E), Dec. 1951; Mandera (3° 59′ N, 41° 45′ E), Dec. 1951; Wajir (1° 45′ N, 40° 5′ E), Feb. 1952.

All these localities are in open mixed scrub. The largest example found was 130 mm. in height; many specimens were immature. Some, however, showed traces of the characteristic longitudinal striping of *hamillei.*

Achatina (*Lissachatina*) *fulica rodatzi* Dunker.

Achatina rodatzi Dunker, 1852. *Zeitsch. f. Malakozool.* **9,** 127.

Achatina (*Lissachatina*) *fulica rodatzi* Bequaert, 1950. *Bull. Mus. Comp. Zool. Harvard* **105,** 88, pl. 3, fig. 3, pl. 11, fig. 4, pl. 30, fig. 1, pl. 44, fig. 2, pl. 52, fig. 1, pl. 53, figs. 2–3, pl. 54, fig. 1.

Northern Province, Kenya Colony: El Wak, December 1952. One dead shell taken among typical *A. fulica hamillei.* Traces of the thin, deciduous, pale olivaceous-yellow periostracum are preserved on the body whorl. The sub-species *rodatzi* is little more than an albino race of *hamillei*, with which it agrees in size, shape and sculpture. It has been found further north (7° 30′ N) than any other forms of *A. fulica* on the African continent (Bequaert, 1950, 95).

Achatina (*Lissachatina*) *lactea* Reeve.

Achatina lactea Reeve, 1842. *Proc. Zool. Soc. Lond.*, 55.
Achatina (*Lissachatina*) *lactea* Bequaert, 1950. *Bull. Mus. Comp. Zool. Harvard* **105,** No. 1, 94, pl. 24, fig. 3, pl. 48, fig. 2.

Somaliland : Jubaland : Desheck Wama (Capt. Hunter, 1925). Two examples taken alive, white, stained in places by the lateritic soil, but without trace of periostracum.

Although not collected by Mr. Hemming, this important addition to the known localities for this rarer species is here recorded for the first time. Previous reliable records are likewise from Somalia (Bequaert 1950, 98). The coarse, beadlike sculpture makes this species easily separable from all forms of *A. fulica*.

Limicolaria Schumacher, 1817.

Limicolaria flaminata (Caill).

Cochlogena flaminata Cailliaud, 1823. *Voyage à Mēroë* **2,** pl. 60, figs. 4, 5.

Somaliland Protectorate : Hargeisa (9° 33′ N, 44° 5′ E), Dec. 1950. On low stony hills in thin scrub. Dead shells, most of them immature; two adults show traces of the characteristic brown flammules.

ENIDAE.

Zebrinops Thiele, 1931.

Zebrinops maunoiriana (Bourguignat).

Limicolaria maunoiriana Bgt., 1882. *Mission G. Revoil au Pays Comalis.* Moll. terr. et Fluv., 48, pl. 2, figs. 29–30.

Hargeisa (Dec. 1950), fairly common.

Zebrinops revoili (Bourguignat).

Limicolaria revoili Bgt., 1882. *Mission G. Revoil au Pays Comalis.* Moll. Terr. et Fluv., 42, pl. 2, figs. 24, 25.

Hargeisa (Dec. 1950), in scrub with *Z. maunoiriana*, but scarcer.

Pseudoglessula O. Boettger 1892.

Pseudoglessula boothi (Tomlin).

Buliminus (*Cerastus*) *boothi* Tomlin, 1916. *J. Conchol.* **13,** 54–6 (with text-figs.).

Described as a species of *Cerastus* (Albers) Martens, 1860, but referred to *Pseudoglessula* on account of the ribbing present on the first 1½ to 2 whorls. In true *Cerastus* these early whorls are smooth as in *C. abyssinicus* (Ruppell).

Hargeisa (Dec. 1950), fairly common.

ARIOPHANTIDAE.

Zingis Martens, 1878.

Zingis (*Bloyetia*) *solida* (Preston).

Martensia solida Preston, 1913. *Rev. Zool. Afr.* **3,** 49, pl. 5, fig. 5.

Northern Province, Kenya Colony : Wajir (Feb. 1952), in open mixed scrub ; living examples in a state of aestivation as well as dead shells, common.

POMATIIDAE.

Otopoma Gray, 1850.

Otopoma (Georgia) perriei Bourguignat.

Otopoma perrieri Bgt., 1881. *Moll. rec. en Afrique dans le pays de Com. Medj.*, 4.

Georgia perrieri Bgt., 1882. *Mission G. Revoil au pays Comalis.* Moll. Terr. et Fluv., 73, pl. 3, figs. 50–1.

Hargeisa (Dec. 1950), amongst thin scrub, common.

Otopoma (Georgia) guillaini (Petit).

Cyclostoma guillaini Petit, 1859. *J. Conchyl.* **1**, 51, pl. 4, fig. 3.

Italian Somaliland : Mogadishu, on sand dunes, very abundant.

Tropidophora Troschel, 1847.

Tropidophora (Ligatella) guillainopis Bourguignat.

Cyclostoma guillaini Pfeiffer, 1853 (non Petit). Monograph of *Cyclostoma* in Martini and Chemnitz, *Conch. Cab.* (edit. 2), no. 234, pl. 34, figs. 7–8.

Rochebrunia guillainopsis Bgt., 1882. *Mission G. Revoil au pays Comalis.* Moll. Terr. et Fluv., 81.

Mogadishu, on sand dunes, with *O. (G.) guillaini.*

Tropidophora (Ligatella) anceps Martens.

Cyclostoma anceps Martens, 1878, in *Monatasberichte d. Berlin Akad.* S. 288, Taf. 1, fig. 4.

Northern Province, Kenya Colony : El Wak (Dec. 1950), Wajir (Feb. 1952).

AMPULLARIIDAE.

Ampullaria Lamarck, 1799 [= *Pila* Bolten, 1798].

Ampullaria wernei Philippi.

Ampullaria wernei Phil., 1851. Mon. Amp. in Martini and Chemnitz, *Conch. Cab.* (edit. 2), 19, no. 22, pl. 17, fig. 2, pl. 5, fig. 4.

Ampullaria wernei Alderson, 1925. *Studies in Ampullaria*, 89, pl. 18, figs. 2, 5, 6.

Northern Province, Kenya Colony : Habaswein (1° 1′ N, 39° 30′ E.), Dec. 1951. On extensive plains of black cotton soil, subject to seasonal flooding. Found together with *Lanistes carinatus*, but less common. The examples of *A. wernei* are, as may be expected from a semi-desert locality, small and stunted in appearance.

Ampullaria speciosa Philippi.

Ampullaria speciosa Phil., 1849. *Zeitschrift. f. Malak.*, 18.

Ampullaria speciosa Alderson, 1925, *Studies in Ampullaria*, 97, pl. 19, figs. 5, 6.

Pila speciosa Pain, 1949. *J. Conchol.* **23,** 69.

Kenya–Somaliland Border : between Garissa (Kenya) and Kismayu (0° 8′ N, 41° 30′ E), Jan. 1951. In medium to dense bush, on black cotton soil subject to inundation. This, the first record of *A. speciosa* from the Somaliland–Kenya border, confirms the suggestion I made in 1949 that this might prove to be the extreme southward extension of its range. In the extensive Lorain Swamps in Kenya not far from Garissa only *A. wernei* (Phil.) is found. The latter species is not known from Somaliland.

Note on the generic name *Ampullaria.* Although the earliest name for this genus is *Pila*, the International Commission on Zoological Nomenclature has been requested to suppress this name in favour of *Ampullaria.* The use of the latter name herein anticipates a favourable decision by the Commission.

Lanistes Montfort, 1810.

Lanistes (*Lanistes*) *carinatus* (Oliver).

Ampullaria carinata Oliver, 1804. *Voyage dans l'Empire Othoman* **2,** 39, footnote ; Atlas pl. 31, figs. 2, A–B.

Northern Province, Kenya Colony : near Habaswein (1° 1′ N, 39° 30′ E), Dec. 1951. Dead shells of this species were very abundant at this locality, along with *A. wernei.* Both are frequently found living together and have an extensive distribution in East Africa.

Large *Unio pictorum* (L.) in Nottinghamshire.—Subsequent to the publication of my note in this *Journal* (**23,** 338), I paid another visit to the River Meden in Thoresby Park on 1 August 1953, in company with Mr. A. G. Davis and Mr. T. Pain. Below the third weir we found large *Unio pictorum* living in abundance. The largest example collected measured 139 mm. in length. I again visited the locality on 8 August and collected 77 living specimens, four of which were over 140 mm. in length, the dimensions of the largest being 148 × 67 × 46 mm. My sincere thanks are due to Lt.-Col. W. Holder for granting permission to visit Thoresby Park.

G. W. PITCHFORD.

VALVATA PISCINALIS (MÜLLER) USED BY *PHRYGANEA* IN LOCH LOMOND.

By W. Russell Hunter.

(*Read before the Society*, 21 *November* 1953.)

Larvae of Trichoptera are often found using the shells of various freshwater Mollusca as material for case-building. Further, some instances of carnivorous caddis larvae preying on Mollusca have been recorded : for example, Oldham (1930) observed them eating the eggs of *Planorbarius corneus* (L.), and Slack (1936) noted *Molanna angustata* Curtis feeding on *Lymnaea stagnalis* (L.) and *L. peregra* (Müller). The present note reports utilization of the prosobranch *Valvata piscinalis* (Müller) as both food and case-material by a caddis larva (almost certainly that of *Phryganea varia* Fabricius).

V. piscinalis is one of the most common snails on bottom silts of the sublittoral in Loch Lomond (Hunter, 1953), and larvae of several species of *Phryganea* which occur in the same regions have recently been found to be predatory carnivores. Slack (1954) finds that these caddis larvae consume large numbers of the eggs laid by the Powan (*Coregonus clupeoides* Lacépède) in Loch Lomond each year. In March 1953, I found *Phryganea* eating *V. piscinalis* after breaking through the penultimate whorl of the shell. Only the softer parts of the visceral mass were seen to be consumed, though other parts may be eaten in the natural habitat. During feeding, the hind-limbs of the caddis remain outspread and prevent rolling, while the shell of the *Valvata* is embraced by the other two pairs of limbs (pro- and meso-thoracic legs), and held pressed by them against the mandibles, which gnaw a sub-circular opening about 1 mm. across. The behaviour of the caddis is exactly similar when eating Powan eggs (Slack, personal communication), and it is of interest that the *Valvata* attacked are all of shell-height 3–4 mm., and thus present to the caddis limbs spherical objects of similar dimension to the eggs. It may be that reflex gnawing is brought about in this caddis when any spherical object of this size is held. One difference in the subsequent process of feeding is that the contents of Powan eggs are squeezed out by the two pairs of limbs clasping the flexible egg-shell (Slack, 1954), while in *Valvata* the shell is not compressed but the tissues of the visceral mass seem to be extruded through the opening by the action of the columellar muscle in continuing to withdraw the snail. A factor which may have been of importance in originating this behaviour in larvae of *Phryganea* is that the egg-shells of Powan and the shells of *Valvata* bear a similar film of bacteria and diatoms.

Cases have been examined from fourteen carnivorous specimens of the caddis, and in two of them among the fragments of plant material built spirally into the case are opercula of *V. piscinalis*. One case bears six opercula, the other two ; and in all, the spiral growth-lines and central bosses characteristic of *Valvata* are clearly visible. Unfortunately there can be no certainty that the caddis larvae utilize opercula from the actual snails which they consume. Opercula persist for some weeks after the death of the snails and can be found among the silts of the bottom, though they are never common.

REFERENCES.

HUNTER, W. RUSSELL, 1953. *Proc. Roy. Soc. Edinb.* (B), **65**, 84.
OLDHAM, C., 1930. *Naturalist Lond.*, **879**, 177.
SLACK, H. D., 1936. *J. Animal Ecol.*, **5**, 105.
SLACK, H. D., 1954. *Proc. Ass. Int. Limnol.*, **12** (in the press).

AGRIOLIMAX CARUANAE POLLONERA AS A HOLOCENE FOSSIL.

By JOHN F. HAYWARD, Ph.D., M.Sc., F.G.S.

[PLATE 15.]

A NEW slug to which he gave the name *Agriolimax caruanae* was described by Pollonera in 1891. This author was not acquainted with the living animal but based his description on preserved material and—presumably—on the details supplied by the original collector, Signor Caruana. Although he did not figure either the whole animal or the shell, Pollonera gave a description of the slug and also a figure of the genitalia. These details were quite adequate, so that when the living slug was found in this country by Oldham and others (Watson, 1943, which see for other references) it was possible for it to be identified. More detailed descriptions with figures were published by Pilsbry (1948) and Quick (1949). Quick's description was based upon British material and for the want of a better name the species thus described is referred to as " *Agriolimax caruanae* Pollonera *emend.* Quick ".

Attempts to obtain topotypes have been unsuccessful, so that the slug may have died out in Malta, the home of Pollonera's original specimen or specimens. For some time there has been doubt whether :—

a. The slug was indigenous to Malta and was introduced from there into Great Britain, or

b. The species was indigenous to Great Britain, was introduced into Malta (perhaps in a bale of vegetables) and has since died out in that island.

The British distribution (Ellis, 1951) is mainly in gardens and allotments in the west of England and Wales, and Durham, Edinburgh and Aberdeen, but it is also found in " wild places " in Wales and Cornwall. This does not suggest an indigenous species and the slug remained a problem until the latter part of 1953.

During the past twelve months the present author has been examining the molluscs which he has obtained from Holocene deposits in the Lea Valley, including those of the marsh clay which is found immediately below the subsoil in Rammey Marsh, near Waltham Cross. In the material were two slug shells which strongly resembled juveniles of this species. A re-examination of the material late in the year reopened the whole question, and a further search revealed three adult shells in Holocene material from Eastwood's Pit, Barrington, Cambs. Although fossil slug shells are usually difficult to identify specifically, this particular species has a rather characteristic shape, and as the specimens were quite well preserved no great difficulty was presented. All three were of the elongated form peculiar to this species and two bore the distinctive concave right margin. The five shells were submitted to Dr. H. E. Quick who agreed that they bore a striking resemblance to the shells of living members of the species, so that there is a *prima facie* case for regarding it as indigenous to this country.

The discovery introduced one additional problem, since no records of the living slug had hitherto been made in the eastern counties. Dr. Quick has, however, recently identified this species in material sent to him by Dr. A. H. Abdora from St. Albans, Herts., that is in the same county as the Rammey Marsh shells.

It is hoped that other workers in the field of Holocene stratigraphy will be stimulated to watch for this shell in their collections.

The author is indebted to Dr. H. E. Quick for critically reading the first draft of this note and to Mr. P. C. Lodge for taking the photographs reproduced on plate 15.

REFERENCES.

ELLIS, A. E., 1951. Census of the distribution of British non-marine Mollusca. *J. Conchol.* **23**, Nos. 6 and 7.

PILSBRY, H. A., 1948. *Land Mollusca of North America.* **2**, 557.

POLLONERA, C., 1891. Appunti di Malacologia. VII. Intorno ai Limacida di Malta. *Boll. Mus. Torino.* **6**, No. 99.

QUICK, H. E., 1949. Synopses of the British Fauna. No. 8. Slugs. *Linnean Society of London.*

SPARKS, B. W., 1952. Notes on some Pleistocene Sections at Barrington, Cambridgeshire. *Geol. Mag.* **89**, 163.

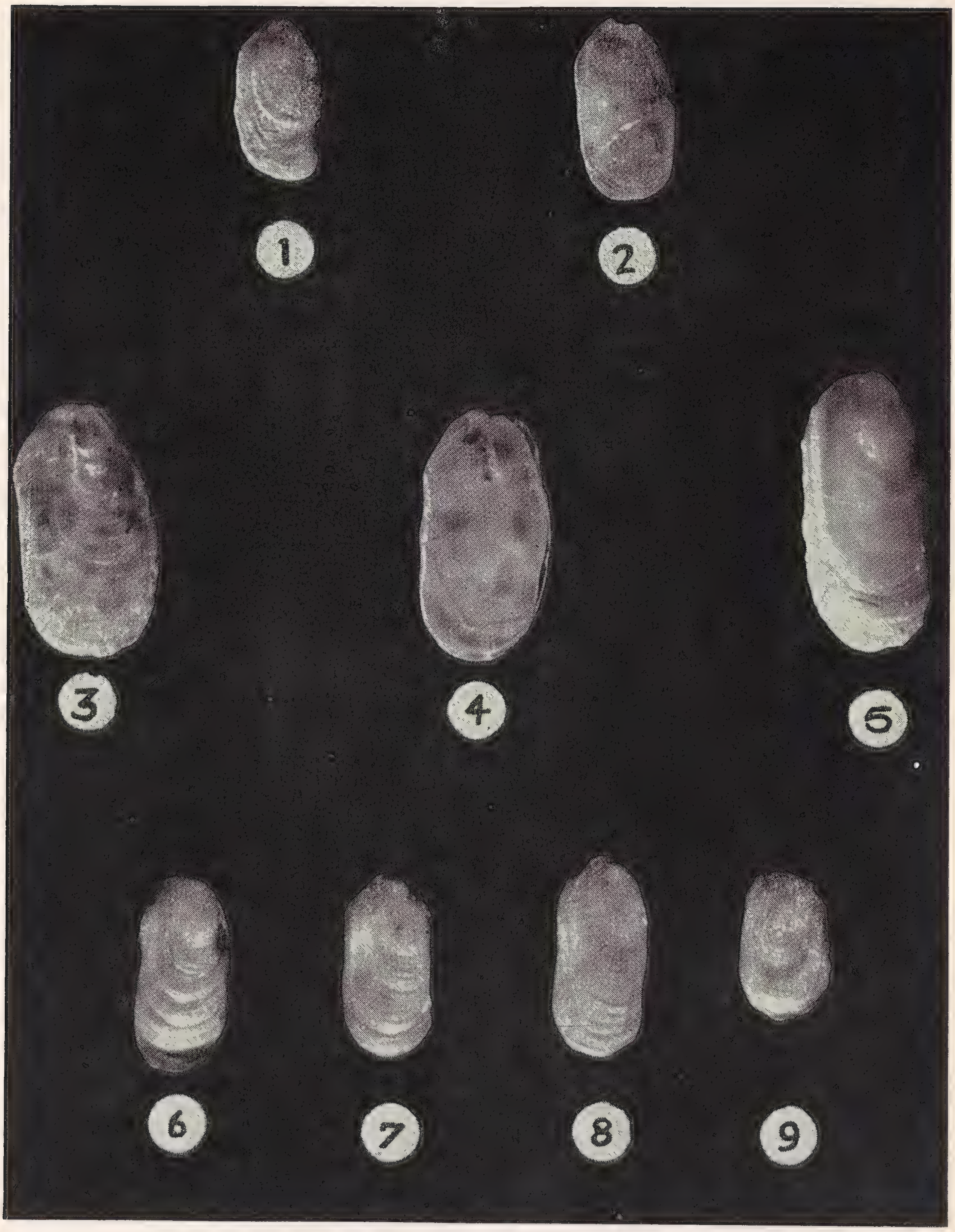
WATSON, H., 1943. Notes on a list of the British non-marine Mollusca. *J. Conchol.* **22**, 54.

EXPLANATION OF PLATE 15.

FIGURES 1, 2.—Two specimens of *Agriolimax* sp. juv. cf. *A. caruanae* Pollonera *emend.* Quick. Dorsal aspect. × 6. Marsh Clay, Holocene. Rammey Marsh. Twickenham Gravel Company's pit, Waltham Cross, Herts.

FIGURES 3–5.—Three specimens of *Agriolimax* cf. *caruanae* Pollonera *emend.* Quick. Dorsal aspect. × 6. Holocene, Sites A–D of Sparks, Eastwood's Pit, Barrington, Cambs.

FIGURES 6–9.—Four specimens of the shell of *Agriolimax caruanae* Pollonera *emend.* Quick. Dorsal aspect. × 6. Living. Porteynon, Glam. Specimens presented to the author by Dr. H. E. Quick.



Agriolimax caruanae Pollonera.

[*Facing p.* 404.

ON *ARIANTA ARBUSTORUM* (L.)

By L. W. Stratton.

(*Read before the Society*, 16 *January* 1954.)

The purpose of this paper, apart from imparting a certain amount of information, is to encourage a deeper consciousness of the ecological interest which presents itself to us on our expeditions in search of snails. When on these expeditions, we are all prone at times to let the collecting instinct become dominant, and forget to ask ourselves such elementary questions as, " Do I usually find this species in this sort of place ? If not, why not ? "

I have, therefore, taken a well-known and widely distributed species, *Arianta arbustorum* (L.), investigated the literature on it (though not as thoroughly as I should like to have done), compared this with the experiences of active conchologists who observe as well as collect, and I have reached the not very remarkable conclusion that mere recording is not enough. I am quite sure that a note in our *Journal* of any unusual habitat is fully justified.

Arianta arbustorum has been recorded for every county and vice-county in Great Britain except Lundy and the Isle of Man, and for twelve in Ireland. With the varying topography and climatological conditions covering this wide distribution, it would be unreasonable to assume that the species occurs always in the same sorts of habitats, yet nearly all the early authors give the impression that it occurs only in wet, damp, or moist places. This may be due to lack of space when writing a text-book, so that only the more usual habitats are given, but this can be very misleading and prompted Mr. A. W. Stelfox to suggest, in a recent letter, that the text-books are not always correct ; yet from what is the beginner to learn, if not the text-books ?

From Turton (1819) onwards, through Gray (1840), Sowerby (1854) Jeffreys (1862), Tate (1866), to Step (1902) the emphasis is on moist habitats, in such places as woods, hedgerows and by the waterside, with reeds, willows and alders specifically mentioned. Only Adams (1884) writes of a dry habitat—" dry ditches ". It is also surprising that only Forbes and Hanley (1852) mention *A. arbustorum* as a mountain species. Taylor (1914, p. 422) has more to say, but gives the same sorts of places, adding, " It is very responsive to moisture," though he gives other sorts of habitats as well, including the mountain one. Ellis (1926) says, " It inhabits moist woodlands, hedges, copses and the borders of meadows, always in rather damp situations, especially amongst nettles."

It is not till we come to Boycott that we get a wider picture. He gives a good deal of information scattered in short passages through two long papers. In his " Land Mollusca of the Parish of Aldenham " (1921), he writes (p. 238) of *Ashfordia granulata* (Alder), which in Aldenham is found only by the waterside in wet places, " It may be that the higher standard of life in the south-east and the consequential greater intensity of agriculture has here driven it to a refuge in one of the few spots that is pretty well undisturbed and which it finds tolerable. *Arianta arbustorum*, confined in civilized parts to river valleys or high hills, would be a parallel to the latter hypothesis, for there is nothing in common between the two sorts of places it lives in except that they are relatively wild." Of *A. arbustorum* in Aldenham he says (p. 241), " is confined to the Colne Valley, where it is not common ; it is a species which seems quite intolerant of cultivation, except in wet places, and commonly lives near our rivers for the same reason as the alder, not because it likes it, but because it has no choice in most places." In " Habitats of the Land Mollusca in Britain " (1934) Boycott says (p. 17), *A. arbustorum* lives " often in osier beds and wet places as well as on mountains and northern sandhills ", and enlarges on the last by saying it occurs, with *Helix hortensis* Müller, on blown sand in Sutherland and Caithness, and is " unknown in similar situations further south " (p. 7).

Boycott does not include *A. arbustorum* in a list of twelve obligatory hygrophiles, but does include it in a further list (p. 14) of twelve species which " frequently occur in damp meadows and marshy places, though they live equally well or better in other habitats ; they may often be found abundantly in the rejectamenta of floods ". They " also occur freely in dry places and all of them might be common in e.g. a beech wood on chalk and in many old hedge banks except *Helix arbustorum*, [*Vallonia*] *excentrica* and [*Vertigo*] *pygmaea*, which prefer more open situations ".

We have then a suggestion why *A. arbustorum* lives in wet places—intolerance of cultivation ; but we are also informed that it does live in dry places. From Adams (1896) we have a suggestion that the species might be calcicole. Boycott (1934) includes it in a list of 45 species indifferent to lime, in that, although it may be found abundantly in places rich in calcium, it may live equally well in places of low calcium content. He remarks also upon the fact that, of the 45 species, *A. arbustorum* is the only one with a substantial shell. In another place (p. 11) he says, " In nature very thin-shelled examples of *Helix aspersa*, *H. nemoralis* and *H. arbustorum* have been found in acid places."

From all this we have a fairly composite picture of the sorts of places in which *A. arbustorum* lives, even if some of them appear somewhat contradictory, but before considering it further, a brief discussion on habitats may be useful. Let us first take the " wet " complex. What constitutes a " wet " or " dry " habitat ? We are considering the British Isles only, and it is probably true to say that really wet or really dry habitats, e.g. jungle or desert, do not occur here. In Britain, our driest places are walls, trees and open chalk downs, and I cannot say I have ever found *A. arbustorum* in any of these places, although Taylor says, " it is commonly found on old lichen-covered walls and on shrubs." Such terms as wet, moist, damp and dry are comparative ones and must vary according to the country under consideration ; in the case of the British Isles this variation is within fairly small limits.

Climatically, Ireland and the west of England and Scotland are wetter than the eastern parts, due to the greater rainfall, which may vary from over 100 inches in some places in the west of Scotland to 22 inches in East Suffolk. With this must be coupled humidity. Deep, tree-shaded valleys and glens would tend to conserve moisture and maintain a high humidity.

Woods of various types can vary considerably in the humidity of the atmosphere enclosed within them. Dampness is also affected by two interrelated geological factors, drainage and soil types. The latter affects the former, in that a loose soil drains more quickly and can remain dry for longer periods than a close soil. The slope of the land also affects drainage ; steep slopes are drier than shallow ones ; the upper parts of a slope are usually drier than the lower ; valley bottoms are usually fairly damp. Slopes facing south tend to be drier than those facing north. A further factor is the scrub and ground-layer flora. In woods these vary according to the type and closeness of the tree layer, and it is the closeness of the scrub layer which largely determines the humidity in woods. The close canopy of the beech produces the bare-floor beech woods of the Chilterns, with here and there a sparse scrub layer of elder with little or no ground layer, or no scrub layer at all and a ground layer commonly of dog's mercury. In the New Forest beech woods the elder scrub layer is replaced by holly.

All these factors tend to produce a climate within a climate, but they also apply equally to the small areas which make up the domain of the individual snail, producing the all-important micro-climate within which the snail lives. Hedges and hedgebanks can vary as much as woods. Thorn hedges are drier than mixed hedges, the humus produced from fallen leaves is usually less, and thus thorn hedges are usually poor places for snails. Hedges grow on the tops of banks, and are often accompanied by ditches. These vary a good deal. Hedges at Tring, in Hertfordshire, have banks and ditches. In summer the ditches are completely hidden by the lush growth of the ground layer, growing almost hedge high. Here is a moist habitat, with a great profusion of snails.

The heights of banks and depth of ditches vary, creating varying micro-climates. Banks without hedges afford a different type of habitat, and different sides of a bank, or banks on opposite sides of the road, may have entirely different micro-climates, these being further affected by the kind of vegetation and by the run of the bank, north and south or east and west. They can be downs in miniature. The soil factor plays a large part in creating types of banks, both in drainage and vegetation. Chalk can be wet and sticky, but loose chalk can be a dry habitat. Calcium carbonate is an important factor, and Boycott has a deal to say on the subject, but I have already dealt with this in so far as it affects *A. arbustorum*.

All the above factors must be taken into account when considering the nature of a habitat. Every collector knows of places where he can always find snails, and others where he need go only in wet weather. He chooses, if he is able, a good " mizzling " day, as this is the best collecting time when all habitats are wet ones, but, in determining a habitat, he must have regard for all these factors, and at least reach some conclusion on its condition after a comparatively long spell of dry weather.

If we now take the dicta of the authors and consider them in the ligh of the above influential factors, it would appear that they do not present a complete picture of the kinds of places in which *Arianta arbustorum* lives. They all seem to be correct as far as they go, but so many of them do not go far enough. And how are we to reconcile Taylor's statement that "when crawling about (it) usually keeps deep down amongst the herbage", with that of Boycott which says it prefers more open situations? It is probably true to say that if one wished to collect this species in quantity, one would choose a riverside habitat, and that, generally speaking, has been my own experience.

In Aldenham, where once it was scarce, *A. arbustorum* now lives abundantly all along the Colne Valley. It lives in an osier bed (undoubtedly one of Boycott's), among nettles and profusely in willow herb (*Epilobium hirsutum*) and among reeds right down to the water's edge, associating with such hyrophilous species as *Zonitoides nitidus* (Müller), *Succinea putris* (L.) and *S. pfeifferi* Rossmässler. It lives in a wood rising fifty feet above the valley floor on a chalk escarpment. The wood is mixed and the scrub layer varies, with a good deal of elder in some places, planted shrubs in others. *A. arbustorum* lives, not as one would expect, at the bottom of the slope, but roughly half-way up, where it is found in quantity under the elder in moss under a ground layer of dog's mercury. The soil is loose chalk, and can be very dry, but I would hesitate to call it a dry habitat, as humidity can be high. *Helix nemoralis* is there in small numbers, but the commonest associate is *Hygromia hispida* (L.).

A. arbustorum occurs plentifully with *H. nemoralis* and *Pomatias elegans* (Müller) on a chalk bank surmounted by hazel, among nettles and brambles; in a well-wooded chalk pit under a scrub layer of elder, with *Marpessa laminata* (Montagu) and *Discus rotundatus* (Müller); and, in smaller numbers, near the top of the chalk escarpment, in what may be termed a transitional hedgerow, in that it is probably a relic of ancient woodland. The cornfield inside the hedge is some four feet above the lane on the other side; the bank, apart from the bare scrub on the top, is completely devoid of vegetation in the winter. With *A. arbustorum* lives *Pomatias elegans*, *Monacha cantiana* (Montagu) and *H. nemoralis*, and I have found dead shells of *Helicigona lapicida* (L.) and *Helicella itala* (L.). This I regard as a dry habitat. It also occurs sparingly under dead beech leaves in a bare-floor beech wood on the other side of the lane (Stratton, 1950).

Some two miles from the river area, at Round Bush, fine large specimens of *A. arbustorum* may be found in plenty on a roadside bank, among some nettles, but mainly in grass. The bank, which has no scrub at all, borders a metalled road, on which I have seen these snails crawling in wet weather. On the other side, again some 3 to 4 feet above road level, is a field under intense cultivation. *A. arbustorum* lives there with *Helix aspersa* Müller, *H. nemoralis* and *H. hortensis* and, in the last ten years, has spread a considerable distance along the bank. The habitat is dryish, on sandy gravel over chalk. A smaller colony lives about ¾ mile away at Kemp Row on a roadside bank and in a ditch with a mixed hedge behind The ditch is moist but the bank is dry enough.

In Hampshire I have found *A. arbustorum* only in wet places along the Avon Valley, but in Bucks it occurs in varying habitats. At Lane End it lives in nettles round a swallow-hole in a hollow which is flooded in winter; in a damp situation on the valley bottom; but also at the edge of a beech wood under buckthorn and guelder rose, with *Helicella itala* a few feet away in the field. I found it recently at Great Missenden on a loose chalk bank rising at 60°, in moss which was so dry it was falling away. It lived with *H. nemoralis* and *P. elegans*, but also with *Helicella caperata* (Montagu) and *H. gigaxi* (L. Pfeiffer), which two species Boycott nominates as xerophiles. At the top of the bank was a thorn hedge, behind which were allotment gardens. I should call the habitat a dry one.

Stelfox tells me that, in the early part of the century, he collected in the Home Counties, south of the Thames, where he found *A. arbustorum* in many roadside hedges in dry situations.

These few observations for the southern part of the country tend to show that the species may live in quite dry places ; that it may not be so intolerant of cultivation as Boycott suggests, though I cannot say that I have seen it crawling out in the fields as several species of *Helicella* will do. It will also live freely in both closed and open habitats. Boycott (1934, p. 17) says, " *H. cantiana* and *H. arbustorum* both have a curious habit of sitting out on herbage exposed to the sun, especially when young ". This I have observed with young snails on willowherb in the water meadows. The adults seem to keep to the ground below, thus bearing out Taylor's statement. Perhaps this is true of this kind of habitat, but at Round Bush I have seen *A. arbustorum* and its associated species crawling over and feeding on a heap of garden rubbish in broad daylight and completely in the open.

From the north of England Mr. J. F. M. de Bartolomé sent me specimens from Lathkill Dale, Derbyshire. The site is in a deep, narrow, well-wooded dale, obviously with high humidity, as Mr. Bartolomé describes it as " dank ". Mrs. Morehouse sent me specimens and information for various parts of Yorkshire, where it occurs on roadside banks, and on pieces of wood and under logs in woods. The habitats vary, but some appear to be dry ones, and, in one case, *Helicella virgata* (da Costa) is mentioned as an associate. The only mountain habitat I have is for Gordale Scar, Malham, Yorks, where it lives on limestone above the tarn with *H. nemoralis*. The rainfall at Malham is 60 inches at 1,300 feet, so there is a good deal of moisture.

Information about mountain habitats in Scotland has not been easy to get, but Stelfox found *A. arbustorum* on Ben Lawers (Mid Perth) at 3,800 feet, within 200 feet of the summit. There it lives " amongst alpine plants on cliffs and such places, often where snow lies for six or seven months of the year ". Laidlaw (1908) also reports it on Ben Lawers and on a neighbouring hill at 2,500 feet. *British Rainfall* gives 61 inches at 700 feet at Glenlyn below Ben Lawers, but a good deal of this must be snow, which is entirely seasonal ; more information is required before conditions can be fully assessed.

Mr. W. Russell Hunter has sent me specimens and data from western Scotland. One of his habitats on Garbh Eileach, one of the Garvelloch group, is a dry one " among tumbled stones in an old sheepfold built on very thin soil and in places on native rock, quartzite. The whole patch is drained well and dries rapidly ". The other habitat is a damp one. On the island of Lismore and on the opposite mainland, south of Port Appin (v.-c. 98, Main Argyll) *A. arbustorum* occurs " in damp hollows on raised platforms of marine erosion under overhanging cliffs ". An interesting habitat is in Dumbartonshire, " in the glen of the Murroch Burn, about two miles north of the town of Dumbarton, on a small patch of gravel occupying a meander of the burn. The dominant plant over most of this area is coltsfoot (*Tussilago farfara*), and both *A. arbustorum* and *H. hispida* are plentiful and *H. subrufescens* (Miller) occurs. For the greater part of the year it could be classed as a ' dryish ' habitat."

Macgillivray (1844) gives a number of localities for *A. arbustorum* along the east coast of Scotland, and for the north-eastern coast Taylor (p. 432) records it " on a cold exposed rock, 800 feet above the sea, Loch Brora ", Sutherland. Along the northern coast the species occurs on blown sand, It was first recorded in this kind of habitat by Peach (1864) at Castlehill, Murkle, and Reay. In 1928, Oldham visited this Caithness area (Oldham, 1929), and, while he did not find it at Peach's station, found it close by on the southern shore of Dunnet Bay on " dunes sparsely clothed with maram grass and behind them a wide expanse of sand " covered with short grass and herbage. *A. arbustorum* was plentiful, with *H. hortensis*, *Helicella itala* and, more rarely, *H. caperata*. I am not at all sure whether there is any indication of the habitat being a dry one in the presence of the two xerophiles. In this close proximity to the sea humidity is nearly always fairly high, and Oldham was there on a wet afternoon in July. At Woolacombe, in North Devon, on sand dunes clothed with short grass, I have found *Helicella virgata* and *H. caperata* active throughout a bright, sunny day in October, with a stiff sea breeze blowing. Whether *H. hortensis* and *A. arbustorum* would be on the move under such conditions is doubtful, as the greater exposure of their larger bodies would be more liable to drying. But in another connection Oldham writes this very significant passage, " One usually thinks of *arbustorum* as a shade loving creature, addicted to lush herbage, and it was odd to see it crawling on the bare sand among the maram grass." Oldham found that it still lived at Reay, and also at Bettyhill in Sutherland on rocks above a steep sandhill with *H. itala*.

Of *A. arbustorum* in Orkney, Mr. R. Rendall tells me he has usually found it " on cliffs that were broken into gullies and had herbage more or less from top to foot, and so retained a good deal of dampness from the clayey subsoil, even in summer ".

In Ireland, *A. arbustorum* lives only in the northern half of the country, and then not in all the counties. For a description of its habitats I cannot do better than quote from information kindly sent to me by Mr. A. W. Stelfox. " In Ireland, it does not occur in ' wet ' places, but in shady places kept ' damp ' by shade rather than wet. In N.E. Ireland (Antrim and Derry) it occurs chiefly in the steep glens running north-east and north off the basaltic plateau ; that is from about 700–800 feet down almost to sea-level. The basalt lies over the chalk, and hence the lower part of the glens is usually cut through the chalk, from which many springs gush out and keep the air moist beneath the hazel scrub along their sides. R. J. Welch used always to associate *arbustorum* with the wood rush (*Luzula sylvatica*), but it is also found hiding under large ferns. If it occurs in damp or really wet places, then the water is running and never stagnant.

" In the Sligo-Leitrim area of carboniferous limestone it certainly occurs up to 1,500 feet amongst a semi-alpine vegetation, but in these areas this vegetation is kept damp by constant mists at night even in dry weather and, of course, the rainfall is fairly heavy, but the drainage is exceptionally good. In its few known habitats outside these two areas—in Armagh, Cavan (and Westmeath, where I do not know its reported habitat), it occurs among brambles, nettles, etc., on normally fairly dry ground."

Stelfox goes on to say that *A. arbustorum* has never become a hedgerow species in Ireland as it is in south-east England. He suggests that the southern English form is probably, biologically speaking, a different race which arrived from the Continent at a more recent period than that found in Ireland and Scotland, and possibly the North of England.

British Rainfall gives records for Northern Ireland only, and in the Antrim–Derry area rainfall varies from the upper 30's at about 100 feet to the upper 40's at 850 feet. In Armagh it reaches a maximum of 37 inches at 260 feet.

There are one or two interesting points about *A. arbustorum* which so far have not been dealt with. The first is mentioned by Taylor (1914, p. 422), who says, " it is a very hardy species, enduring greater cold, and extending further north as well as to a greater altitude in the mountains than *Helix hortensis* and other allied species," and he reports its occurrence in northern Italy at 9,000 feet. In Britain it certainly occurs further north than *H. aspersa* or *H. nemoralis*, but we have no heights to compare with the Alps, although, as has been shown, it can be a mountain species in Britain. Forbes and Hanley (1852) also refer to it living on mountains, and Stelfox sent me shells collected by Collier at 8,000 feet in Switzerland. He writes, " I collected two specimens at about 4,750 feet at Finse in Norway, on a patch of bare hillside surrounded by snowfields, and I was assured by a local man that my bare patch had not been uncovered by the snow melting for several years. Strangely enough, these shells were larger than some taken a few hundred feet above sea-level near the Sogne Fjord about 30 miles away."

This brings me to the second point of interest ; coloration, shape and size. Within certain limits, there is quite a good deal of variation within the species. There do not appear to be any controlling factors governing these variations, though presumably the form called *alpicola* Férussac was intended to mean the small conoid form often met with on mountains. This form, or one very near to it, seems liable to turn up in any sort of situation, and I have found it in the water meadows in Aldenham, where nearly every possible shape occurs, and many colour forms. In the Round Bush colony, however, all the shells are large, rather flattened, and of a dark colour, the only variation being an occasional unbanded shell. There is no evidence at present to show that food has much, if any, effect on coloration. We know little about the food of the species. Does it feed on the green parts of plants, the dead leaves, or fungoid growth on them ? The wide variety of plants among which it is found suggests a profitable line of research, not only from a food point of view, but in connection with shade and the conservation of moisture, which is more or less necessary to all snails in dry weather.

To sum up, I would suggest that the following points have been made : that *A. arbustorum*, while being most commonly found in moist places, can and does live in places which, for Britain, may be termed dry or dryish. Its occurrence with xerophiles in places away from the sea tends to confirm this. Further, that it can live equally well in closed and open habitats, and also, that it may not be as intolerant of cultivation as Boycott suggests. It is also very clear that there is still a great deal to be learned about the species, and it is hoped that this paper will encourage further investigation.

I am greatly indebted to Mr. A. W. Stelfox, not only for his information on Irish *A. arbustorum* and the gift of specimens, but also for his interest in and helpful criticism of this paper. My thanks are also due to Mr. J. F. M. de Bartolomé, Mr. W. Russell Hunter, Mrs. Morehouse, and Mr. R. Rendall for information and the loan or gift of specimens. I should be pleased to hear from field workers in any part of the British Isles who may be able to add to, or who may disagree with, the points herewith set out.

REFERENCES.

ADAMS, L. E., 1884. *Collector's Manual of British land and freshwater Shells*, 64.
—— 1896. *Ibid.*, 2nd edition, 73.
BOYCOTT, A. E., 1921. *Trans. Herts. Nat. Hist. Soc.* **17**, 220–245.
—— 1934. *J. Ecol.* **22**, 1–38.
British Rainfall, 1951. H.M. Stationery Office.
ELLIS, A. E., 1926. *British Snails*, 221.
FORBES, E., & HANLEY, S. C. T., 1852. *History of British Mollusca* **4**, 49.
GRAY, J. E., 1840. *Turton's Manual of the land and fresh-water shells of the British Islands*, new edition, 138.
JEFFREYS, J. G., 1862. *British Conchology* **1**, 189.
LAIDLAW, F. F., 1908. *J. Conchol.* **12**, 192.
MACGILLIVRAY, W., 1844. *History of the Molluscous Animals of Scotland*, 82.
OLDHAM, C., 1929. *Proc. Malac. Soc.* **18**, 144.
PEACH, C. W., 1864. *Proc. Roy. Phys. Soc. Edin.* **3**, 162.
—— 1864. *J. Conchol.* **4**, 225.
SOWERBY, G. B., 1854. *Popular British Conchology*, 243.
STEP, E., 1902. *Shell Life*, 357.
STRATTON, L. W., 1950. *Trans. Herts. Nat. Hist. Soc.* **23**, 100–127.
TATE, R., 1866. *Land and fresh-water Mollusks of Great Britain*, 137.
TAYLOR, J. W., 1914. *Monograph of the land and freshwater Mollusca of the British Isles* **3**, part 20.
TURTON, W., 1819. *Conchological Dictionary of the British Islands*, 56.
WILLIAMS, J. W., 1888. *Shell-Collector's Handbook*, 112.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

724th Meeting, held at the British Museum (Natural History), 17 October 1953.

The President in the chair.

Member Deceased.

The President announced the death on 7 August of Arthur George Wrigley.

Communications.

" Notes on the Mollusca of the Garvelloch Islands," by W. Russell Hunter.

" A survey of some Orkney beaches," by Robert Rendall.

" A note on the distribution of *Anodonta cygnea* (L.), having regard to the differences in sex and gill-structure. IV," by H. H. Bloomer.

" Notes on a collection of non-marine Mollusca from semi-desert areas of East Africa," by T. Pain.

Exhibits.

The President: The original drawing for the cartoon entitled " The Conchological Society of Great Britain and Ireland makes a record haul ", in the Coronation number of *Punch*, presented to the Society by the artist, Mr. Ronald Searle.

Living specimens of *Arianta arbustorum* and *Helix aspersa* from Tornewton Cave, Torbryan, South Devon, collected by J. N. Carrack and M. W. Reid; living *Vertigo moulinsiana*, Harting, West Sussex, collected by M. Goodchild.

Mr. C. P. Castell and Mr. G. W. Wilkins: British Eocene marine Mollusca and comparable recent Indian Ocean species, from the British Museum collections.

Mr. T. Pain: East African *Achatina*.

Mr. G. W. Pitchford: *Acavus* from Ceylon, collected by Mr. G. A. S. Barnacle; *Unio pictorum* 148 mm. in length, Thoresby Park, Notts.

725th Meeting, held at the British Museum (Natural History), 21 November 1953.

The President in the chair.

Member Deceased.

The President announced the death of E. D. Bostock, who was elected a member of the Society in 1884 and served as Hon. Treasurer from 1898 to 1917.

Election of Member.

Mark H. Williamson, M.A., Fairfield, Pullens Lane, Oxford.

Communications.

" Correction of the type locality of *Pomacea cumingi* (King)," by J. P. E. Morrison (communicated by Mr. T. Pain).

" Note on *Valvata piscinalis* (Müller) providing both food and building material for Caddis larvae," by W. Russell Hunter.

Dr. H. E. Quick described the technique of preparing and mounting radulae.

Exhibits.

The President: *Sphaerium transversum*, *Anodonta cygnea* and *Unio pictorum*, Chichester Canal, collected by M. Goodchild, October 1953.

Dr. J. F. Hayward: Holocene shells of *Agriolimax caruanae*, Lea Valley and Barrington, Cambridgeshire.

Mr. T. Pain: specimens to illustrate Mr. Morrison's communication.

Dr. H. E. Quick: *Ferrusacia folliculus* (Gronovius), Adelaide, South Australia, collected by B. C. Cotton; shells of slugs; slides of radulae.

Mr. G. L. Wilkins and Mr. C. P. Castell: Chitons and their radulae from the Winckworth collection; slides of radulae prepared by Lt.-Col. Peile; Dr. Bowell's photographic negatives of radulae: photographs of recent and fossil gastropod tracks.

726th Meeting, held at the British Museum (Natural History), 19 December 1953.

The President in the chair.

Election of Member.

Michael P. Kerney, Vasconia, Crown Dale, Upper Norwood, London, S.E. 19.

Communications.

"Captain Cook's Imperial Sun Shell," by G. L. Wilkins.

Mr. P. Coxhead reported the introduction of *Lymnaea stagnalis* from Bristol into ponds on the islands of Guernsey and Sark.

Exhibits.

Special exhibit: Pectinidae, *Achatina*.

Messrs. G. A. S. Barnacle, H. E. J. Biggs and T. Pain: species of *Achatina* from Africa and Ceylon.

Mr. C. P. Castell: fossil Pectinidae from the British Museum collections.

Mr. L. W. Stratton: Pectinidae from South Australia and New Zealand.

727th Meeting, held at the British Museum (Natural History), 16 January 1954.

The President in the chair.

Election of Members.

H. de Souza Lopes, Instituto Oswaldo Cruz, Caixa Postal 996, Rio de Janeiro, Brazil.

E. Robinson, 8 Sun Wood Avenue, Shelf, Halifax, Yorkshire.

Michael Anthony Salmon, 43 Melbury Court, Kensington, London, W. 8.

Communication.

"On *Arianta arbustorum* (L.)," by L. W. Stratton.

Exhibits.

Special exhibit: Mytilidae and *Placostylus*.

Mr. C. P. Castell: fossil Mytilidae and Dreissenidae from the British Museum collections.

Mr. T. Pain: *Placostylus* from all known localities.

Mr. L. W. Stratton: Mytilidae from Australia and New Zealand; *A. arbustorum* from numerous localities.

Mr. G. L. Wilkins: Mytilidae from the Winckworth collection.

728th (Special General) Meeting, held at the British Museum (Natural History), 20 February 1954.

The President, Mr. A. G. Davis, in the chair.

The minutes of the Special General Meeting of 19 February 1953 were read and approved.

The President stated that all efforts to find alternative suitable accommodation for the Library and Collections, other than that now proposed, had failed and that the Council recommended that the Society's Library be sold and that the Collections be placed on permanent deposit in the British Museum (Natural History). The Collections had been offered by the Council to the Trustees of the British Museum on these terms and with a request that the valuable British voucher collection be maintained as a separate entity, to which the Trustees of the Museum very willingly agreed. Accommodation at Leeds Museum will shortly cease to be available.

The President then moved the following resolution from the Chair:—

"It is hereby resolved,

That the Collections of the Society be deposited permanently in the British Museum (Natural History), subject only to the provision that the British Voucher Collection be maintained as a separate entity.

That the Society's Library be sold and that the proceeds of the sale be invested, the income to be paid into the general funds of the Society."

This resolution was passed unanimously.

729th (Annual) Meeting, 20 February 1954.

The President in the chair.

Election of Scrutineers.

Mr. C. A. Raffray and Mr. G. W. Pitchford were elected Scrutineers.

Election of Auditors.

Miss M. M. Howard and Mr. G. L. Wilkins were re-elected Auditors for 1954.

Statement of Accounts.

The Hon. Treasurer presented the audited accounts for 1953, which were adopted.

Annual Reports.

The reports of the Council, the Yorkshire Branch and the Recorder (Non-marine Mollusca) were presented and adopted.

Votes of Thanks.

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permitting the Society to hold meetings in the Museum; to the authorities of the Leeds Museum for housing the

Society's library and cabinets; and to the Officers and Council for their work on behalf of the Society.

Election of Officers and Council.

The Officers and Council nominated by the Council were elected (see page 389).

Presidential Address.

The President delivered an address on "A Holocene Fauna with *Helicella striata* (Müller) in the Cray Valley, Kent".

Exhibits.

The President: Holocene land shells from Pratt's Bottom, Kent.

Miss M. M. Howard: shells and shell-ornaments from Lachish and Jericho.

Mr. T. Pain: Indo-Burmese Ampullariidae.

Mr. G. W. Pitchford: Greenhouse aliens collected at Kew Gardens by the late Fred Taylor; *Helix aspersa*, Oceanside, California, collected by R. E. Hall; *Helminthoglypta dupetithouarsi*, *Viviparus malleatus* and *Corbicula fluminea*, California, collected by Mr. and Mrs. H. R. Turver; shells of *Anodonta* eaten by the water vole (*Arvicola amphibius*), R. Meden, Thoresby Park, Notts.

Dr. H. E. Quick: species of *Helicella*.

Report of the Council.

During the past year there has been a decrease of six in membership, which now stands at 180 ordinary and two honorary members. The Society has lost three members by death, namely E. D. Bostock, W. F. Buckle, and A. G. Wrigley.

Seven ordinary meetings, an annual and a special general meeting have been held at the British Museum (Natural History), by kind permission of the Trustees. Field meetings were held at Cassiobury Park, Watford; Chaldon, Surrey; Box Hill, Surrey; Dover Castle and Walmer; and Brighton.

Two numbers of the *Journal of Conchology* were issued, namely Volume 23, No. 10, 22 May, and No. 11, 16 October 1953.

The future of the Society's library and collections has been the serious concern of the Council for some time. Owing to the resignation through ill health of Mrs. Thurgood, the Society has been deprived of a Librarian and Curator. After consideration of various alternative plans and consultation with the Society's Trustees, the Council decided that a transfer of the Society's property to London was essential to ensure adequate care and attention. Discussions with the Trustees of the British Museum (Natural History) resulted in their agreeing to accept the collections on permanent deposit.

Report of the Yorkshire Branch.

The year opened with a meeting at the Leeds City Museum, where members inspected the collections and library of the Conchological Society, the J. W. Taylor collection receiving special attention. On

14 February a discussion on *Patella* was opened by Mrs. E. M. Morehouse, who exhibited specimens from many countries, and a paper on the *Patella* of Scarborough by E. A. Wallis was read. At the March meeting Mr. J. H. Lumb gave an illustrated address on "Shells of Jamaica". In April the Branch met again at Leeds City Museum and, after a discussion on Operculates, visited the Mollusca gallery, which has been rearranged by representatives of the Yorkshire Branch and the Museum staff.

The first excursion was to Bolton Percy, where good results were obtained in the ponds and ditches draining into the River Wharfe. Two well attended excursions were held jointly with the Yorkshire Naturalists' Union, the first covering the Wharfe from Collingham to Woodhall, where 26 species were taken, the second to Bretton Park Estate, in appalling weather. The September meeting at Knaresborough was poorly attended and produced meagre results. The Annual Meeting took place in October, when the usual reports were presented. The year ended with a talk by the Hon. Secretary on British Slugs.

Menetus dilatatus (Gould) was taken in the canal at Golcar, near Huddersfield, by Mr. G. Fryer in October, and Mr. E. A. Wallis reported *Crepidula fornicata* (L.) at Scarborough.

S. G. Appleyard, *Hon. Secretary.*

Recorder's Report : Non-marine Mollusca.

Since the publication of the last Report (*J. Conchol.* **23**, 345), the following new county and vice-county records have been authenticated.

Isles of Scilly (1a) : *Arion intermedius*, *Agriolimax caruanae*, *Cochlicopa minima*, H. E. Quick.

Cornwall West (1) : *Cochlicopa minima*, Newtrain Bay, Padstow, A.E.E.

Cornwall East (2) : *Monacha cantiana*, dead shell, Rock (erroneously ascribed to Cornwall West, *J. Conchol.* **22**, 311).

Wilts South (8) : *Cochlicopa minima*, Donhead St. Mary, H. E. Quick.

Sussex West (13) : *Sphaerium transversum* (= *pallidum*), Chichester Canal, Hunston, M. Goodchild.

Herts (20) : *Agriolimax caruanae*, St. Albans, Dr. A. H. Abdora.

Oxford (23) : *Cochlicopa minima*, Chazey Wood and Henley, H. E. Quick.

Bedford (30) : *Milax gagates*, H. F. Barnes.

Nottingham (56) : *Oxychilus draparnaldi*, *Milax budapestensis*, Southwell, *Helicella gigaxi*, between Orston and Kilvington, G. W. Pitchford.

York North-East (62) : *Physa heterostropha* (?), R. Foss, York, A. Smith.

Westmorland (69) : *Milax sowerbyi*, *M. budapestensis*, Barrow-in-Furness, G. W. Pitchford ; *Limax tenellus*, Bouth, Witherslack and Newby Bridge, Dr. J. E. Satchell.

Isle of Man (71) : *Potamopyrgus jenkinsi*, Port Erin, Dr. H. B. N. Hynes.

Lanark (77) : *Potamopyrgus jenkinsi*, Bishop Loch, Lochend Loch and Woodend Loch, near Glasgow, W. Russell Hunter.

Stirling (86) : *Anodonta anatina*, Endrick Water, H. D. Slack.

Main Argyll (98): *Potamopyrgus jenkinsi*, *Lymnaea stagnalis*, *Planorbis carinatus*, Lismore, W. Russell Hunter.

Dunbarton (99): *Planorbis crista*, *P. laevis*, *P. leucostoma*, *Aplexa hypnorum*, Loch Lomond, *P. leucostoma*, Hardgate, *Planorbarius corneus*, Windy Hill, Milngavie (introduced), *Lauria anglica*, Rossdhu, W. Russell Hunter; *Anodonta anatina*, Endrick Water, H. D. Slack.

South Ebudes (102): *Vitrina pellucida*, Garvelloch Isles, W. Russell Hunter.

Sutherland West (108): *Planorbis vortex*, Loch Lanlish, Durness, T. T. Macan.

For details of new Scottish records, see *Glasgow Naturalist* **17**, 84 (1953).

A. E. E.

730th Meeting, held at the British Museum (Natural History), 20 March 1954.

The President in the chair.

Election of Member.

David E. Carmichael, 137 Hamilton Terrace, London, N.W. 8.

Exhibits.

Special exhibit: Pteropods and *Vallonia*.

The President: Pteropods collected on the voyage of H.M.S. *Challenger*.

Mr. C. P. Castell: fossil Pteropods and *Vallonia tenuilabris* from the British Museum collections.

Mr. A. G. Davis: samples of Pteropod ooze; Pleistocene *Vallonia* used by B. W. Sparks in writing his paper on the British species (*Proc. Malac. Soc.* **30**, 110).

Mr. H. F. Jones: Pteropods from J. E. Cooper's collection.

Mr. G. W. Pitchford: British *Vallonia* and South American land snails.

Mr. G. L. Wilkins: original water-colour drawings of living Pteropods made on H.M.S. *Challenger*, *c.* 1874.

LIST OF MEMBERS

Changes of Address.

CURNOW, P. W., Casimir Place, Daliburgh, South Uist, Inverness-shire.

GRIFFITHS, Major R. J., The Manchester Regiment, c/o Lloyd's Bank, Ltd., Cox and King's Branch, 6 Pall Mall, London, S.W. 1.

VENMANS, L. A. W., Nieuwstraat 36, Moergestel, Netherlands.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1953.

Income and Expenditure Account

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
„ Paid in 1952	10	17	9			
„ For 1953	96	7	7			
„ Arrears	22	0	0	129	5	4
„ Sales				63	5	4
„ Transfer from Life Membership Fund				18	18	0
„ Deficit, being excess of expenditure over income . .				131	10	7
				£342	19	3

Cr.

	£	s.	d.	£	s.	d.
By Publication and Distribution—						
Vol. 23, part 8, author's reprints	13	16	0	13	16	0
Vol. 23, part 9 . . .	103	5	11			
Author's reprints . .	10	9	6	113	15	5
Vol. 23, part 10 . .	86	10	8			
Author's reprints . .	15	8	9	101	19	5
Vol. 23, part 11 . .	83	19	11	83	19	11
				313	10	9
„ Printing and Stationery . .				8	2	6
„ Zoological Society . .				2	0	0
„ Zoological Record . .					8	0
„ Insurance				1	0	0
„ Repayment				1	0	0
„ Officers' Expenses . . .				16	18	0
				£342	19	3

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1953 . .	509	14	0
„ Composition Fee	20	0	0
„ Dividends and Interest	18	18	0
	£548	12	0

	£	s.	d.
By transfer to Income and Expenditure Account	18	18	0
„ Amount of Fund, 31 December 1953. .	529	14	0
	£548	12	0

Research and Reserve Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1953	364	18	0	By Amount of Fund, 31 December 1953	377	18	10
,, Dividends and Interest	13	0	10				
	£377	18	10		£377	18	10

BALANCE SHEET.

Liabilities.	£	s.	d.	£	s.	d.
Annual Subscriptions in advance				7	2	0
Life Membership Fund				529	14	0
Research and Reserve Fund				377	18	10
Balance from Income and Expenditure Account—						
As on 1 January 1953	370	5	1			
Less Deficit for 1953	131	10	7	238	14	6
				£1,153	9	4

Assets.	£	s.	d.	£	s.	d.
4% Funding Loan (cost)	350	0	0			
2½% Defence Bonds (cost)	200	0	0			
3½% War Loan (cost)	40	0	0	590	0	0
Cash at Bankers—						
National Provincial Bank	151	19	3			
Post Office Savings Bank	406	10	1			
Cash in hand	5	0	0	563	9	4
				£1,153	9	4

Note.—Assets in addition to those set out in the above Balance Sheet are (*a*) Library, (*b*) Cabinets and Collections, (*c*) Stock of unsold Publications, (*d*) Subscriptions in arrears.

Examined and found correct.
G. L. Wilkins, } Auditors.
M. M. Howard, }
5 February 1954.

Albert E. Salisbury,
Hon. Treasurer.
14 January 1954.

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CORRECTION : p. 154, line 7 from foot, " no *living* specimens were seen ".

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